U.S. Air Force
Logistics Command

United States Air Force Technical Order Management System (AFTOMS)

August 1989

BENEFIT ANALYSIS REPORT

FINAL REPORT

Prepared By

U. S. Department of Transportation
Research and Special Programs
Administration
Transportation Systems Center
Cambridge, MA 02142

Prepared For

U. S. Air Force Logistics Command
HQ AFLC/LMSC/SNT
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This report prepared by the Transportation Systems Center (TSC) concludes an analysis of the Technical Order (TO) costs and benefits, which was originally undertaken as part of the US Air Force Computer-aided Acquisition and Logistics Support (CALS) Program This report examines the overall benefits of Automation, Reduced costs, and increased mission effectiveness. The Air Force Technical Order Management System (AFTOMS) Benefit Analysis Report is a rough order of magnitude study, comparing the costs associated with the current TO system, and the implementation and support costs of AFTOMS, in fulfilling Air Force mission requirements. This report also examines the potential savings that could be realized with the implementation of AFTOMS, by reducing or eliminating the inefficiencies associated with the current TO system during its acquisition, distribution, management and use.

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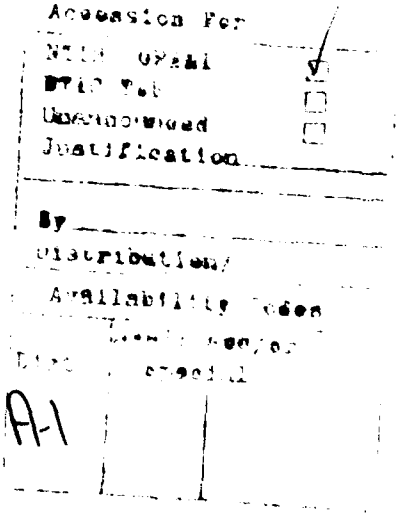
PREFACE

This report prepared by the Transportation Systems Center (TSC) concludes an analysis of the Technical Order (TO) costs and benefits, which was originally undertaken as part of the U.S. Air Force Computer-aided Acquisition and Logistics Support (CALS) Program. This report examines the overall benefits of automation, reduced costs, and increased mission effectiveness.

The Air Force Technical Order Management System (AFTOMS) Benefit Analysis Report is a rough order of magnitude study, comparing the costs associated with the current TO system, and the implementation and support costs of AFTOMS, in fulfilling Air Force mission requirements. This report also examines the potential savings that could be realized with the implementation of AFTOMS, by reducing or eliminating the inefficiencies associated with the current TO system during its acquisition, distribution, management and use.

The work was performed under the direction of Dr. Robert Smith of the Information Integration Division at TSC. TSC has drawn upon the skills and knowledge of several consultants. This has enabled the development of a multi-faceted team of experts, each of whom has made a vital contribution. TSC would like to extend its gratitude to the following organizations: EG&G DYNATREND, Inc., UNISYS, Inc., and Coopers & Lybrand, Inc.

This report is an initial document which will help to establish the parameters of the implementation of AFTOMS. Any comments or inputs are welcome so that the document will be current and useful for the program.



EXECUTIVE SUMMARY

Technical orders (TOs) provide the means of disseminating technical data to Air Force equipment operators, maintainers, trainers, engineers, etc. The current inventory of TOs is continuing to increase, with an estimated total inventory to exceed 23 million pages and 2.3 million change pages. This high volume of paper production does not allow for timely distribution and modification of TOs and creates inaccurate and incomplete technical data. The modification of current Air Force systems, the addition of new Air Force systems to the inventory, and the increased support for foreign military sales has created a demand for a more improved TO management system, using the latest in technologies and standards, consistent with Air Force requirements and appropriations.

Air Force Technical Order Management System (AFTOMS) is a new TO system designed to meet the present and future TO management requirements of the Air Force. This AFTOMS Benefit Analysis Report is a rough order of magnitude study, comparing the costs and benefits associated with the current TO system, and the implementation and support costs of AFTOMS, in fulfilling Air Force mission requirements. This analysis also examines the potential savings that could be realized with the implementation of AFTOMS, in reducing or eliminating the inefficiencies associated with the current TO system.

Some inefficiencies associated with the current TO process include:

- Extensive amount of change pages (10%) produced yearly that must be accomplished because of misinterpretation between users, content managers and editors;
- Extensive length of time (210 days) to implement a TO change;
- Excess of time spent by the Using Command to prepare and review change requests before submission into the current TO management system;
- Inability to handle the increasing volume and complexity of technical data, creation of inaccurate data, and inefficient response to user needs leading to weapon system mishaps.

The cost of the current Air Force TO process is extremely high. The time required to produce new manuals and change pages is increasing. Manuals are increasing in size and cost, and are becoming more complex and difficult to use. Air Force personnel are unable to manage the paper-based system effectively. Limited automation has taken place at the lowest organizational levels, and has correspondingly received limited results. Full automation would bring significant results by improving the accuracy, completeness, timeliness, currency, and ease of using TOs.

The implementation of AFTOMS would:

- Create a 25% cost reduction in producing a TO page (based on the reduction of preparation of masters, printing, distribution and editing manhours needed to create and deploy TOs);

- Reduce the need for face-to-face TO reviews, resulting in a generation of 50% review cost savings;
- Increase the percentage of user and management efficiencies for all levels of jobs resulting in substantial overall savings in labor costs;
- Generate a savings at a rate of 6.6% per year (beginning in 1994 when 19.8% of TOs will be digitized) and a Life Cycle Cost (LCC) savings of $11.2M associated with mailings costs, warehousing costs, printing costs, and change costs due to automation and digitization of technical data.
- Create intangible benefits, such as improved Maintenance Data Collection (MDC), spares requisition, and delivery time.
- Improve workforce productivity, resulting in more maintenance manhours to be applied to repairing aircraft, missiles, etc., translating to increased Mission Capable (MC) rates and aircraft availability.
- Generate substantial cost savings in fuel/payload of larger aircraft because of weight savings from eliminating paper TOs.

The monetary benefits for management and administrative functions resulting from the implementation of AFTOMS is approximately $1.4B over the system life cycle. Additionally, there would be a $15.8M cost avoidance for new construction. The overall monetary benefits to the users would be conservatively estimated at $2.1B over the 15 year system life cycle.

The Air Force currently spends upwards of $58M annually for the Technical Order Distribution Office (TODO) system. A $55.2M savings would be realized, with an LCC of $717.5M, when automation is used to simplify the TODO inventorying, requisitioning, distributing, etc.

Digitizing TOs is estimated to cost approximately an additional $91M. More precise cost data on the conversion process will be available when the TO Conversion Proof-of-Concept (POC) effort is complete. The cost to implement AFTOMS is expected to be $266M over the next seven years, $91M for TO conversion, in addition to $39M per year to maintain the system hardware, software, telecommunications and facilities thereafter. This implementation cost assumes that there will be:

- One Air Force Technical Order Management Agency (AFTOMA);
- Thirteen Regional Centers, Technical Order Management Agencies (TOMA);
- 261 Base Libraries, Consolidated Technical Order Distribution Office (CTODO).
- Nine MAJCOM OPRs

The benefits gained from full automation of the TO process are viewed as an Air Force-wide improvement over the current system. Implementation of AFTOMS has enormous impacts in dollars saved, productivity improvements, cost avoidance, and intangible benefits to the Air Force and will achieve a Return-On-Investment (ROI) in approximately seven to eight years.

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LIST OF ACRONYMS

AAC	Federal Aviation Administration (FAA) Aeronautical Center
A/C	Aircraft
AF	Air Force
AFLC	Air Force Logistics Command
AFLC/DAP	Air Force Logistics Command/Data Automation Panel
AFLC/MM	Air Force Logistics Command/Materiel Management
AFLMC	Air Force Logistics Management Center
AFM	Air Force Manual
AFR	Air Force Regulation
AFRES	Air Force Reserve Forces
AFSC	Air Force Specialty Code
AFSC	Air Force Systems Command
AFTO Form 22	Air Force Technical Order Change Request Form
AFTOMA	Air Force Technical Order Management Agency
AFTOMS	Air Force Technical Order Management System
AGMC	Aerospace Guidance and Metrology Center
ALC	Air Logistics Center
ANG	Air National Guard
ATC	Air Traffic Control
ATOS	Air Force Technical Order System
AV	Average
CTODO	Consolidated Technical Order Distribution Office
EDCARS	Engineering Data Computer Aided Retrieval System
EDSC	Engineering Data Service Center
EEIC	Element of Expense Investment Codes
FTE	Full Time Equivalent
FY	Fiscal Year
G-File	On-board Aircraft Technical Orders File
GM	General Management
GS	Glide Slope
HQ	Headquarters
ICS	Interim Contractor Support
IOC	Initial Operational Capability

LIST OF ACRONYMS (Continued)

LCC	Life Cycle Cost
MAC	Military Airlift Command
MC	Mission Capable
MC Hrs I	Increased Mission Capable Hours
MC Hrs N	New Mission Capable Hours
MC Hrs O	Original Mission Capable Hours
MDC	Maintenance Data Collection
MMHrs	Maintenance Manhours
MMHrs E	Maintenance Manhours Expended
MMHrs I	Maintenance Manhours Improvement
NMC	Not Mission Capable
NMCM	Not Mission Capable Maintenance
NMCS	Not Mission Capable Supply
OC-ALC	Oklahoma City Air Logistics Center
OO-ALC	Ogden Air Logistics Center
ROI	Return-On-Investment
SA-ALC	San Antonio Air Logistics Center
SAC	Strategic Air Command
SM-ALC	Sacramento Air Logistics Center
SPO	System Program Office
TAC	Tactical Air Command
TO	Technical Order
TODO	Technical Order Distribution Offices
TOMA	Technical Order Management Agency
TRC	Technology Repair Center
USAF	United States Air Force
WR-ALC	Warner Robins Air Logistics Center

SECTIONS 1–5

INTRODUCTION

ACQUISITION, REVIEW, AND MANAGEMENT BENEFITS

INTANGIBLE BENEFITS

USER BENEFITS

SUMMARY

SECTION 1: INTRODUCTION

1.1 BACKGROUND

Technical orders (TOs) provide the official means of disseminating technical data to Air Force equipment operators, maintainers, trainers, engineers, etc. The current inventory of more than 200,000 TOs (Computer Program Identification Numbers (CPINs), JMEM, special weapons, etc.) is continuing to increase, with an estimated total inventory exceeding 23 million pages.[1] This manually oriented system uses procedures and technologies defined in the 1940s, and in some instances creates inaccurate, untimely, and incomplete technical data. The current TO system produces a high volume of paper management products that does not include all of the information required to make key management decisions. Additionally, the present system does not allow for timely distribution and modification of TOs, resulting in delayed arrival to the users, and outdated and inaccurate technical content. Improved weapon system capabilities and increased technology complexity have exacerbated the growth of these problems.

Air Force Technical Order Management System (AFTOMS) is a new TO system designed to meet the present and future TO management requirements of the Air Force. The modular structure of AFTOMS will allow phased implementation at a pace consistent with Air Force requirements and appropriations. AFTOMS is focusing on the leading edge technologies and standards that will be used in the TO management system over a long system life cycle.

1.2 PURPOSE

This AFTOMS Benefit Analysis Report is a rough order of magnitude study, comparing the costs of the current TO system, with the implementation and support costs and benefits of AFTOMS, in fulfilling Air Force mission requirements. The high costs of todays support and operator personnel resources, inoperative equipment, mishaps, etc., necessitates the implementation of an automated and digitized TO system. An automated system such as AFTOMS, would reduce costs and improve mission capability. This analysis examines the cost of AFTOMS and the potential savings that could be realized by reducing or eliminating the inefficiencies associated with the current TO system. The current TO inventory is continuing to increase as current Air Force systems are modified, new Air Force systems are added to the inventory, and support for foreign military sales is increased.

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1. Refer to Appendix A, assumption a.

1.3 CURRENT DEFICIENCIES

One ineffciency of the present TO process is the continuing amount of changes to the TO inventory. The Air Force produces more than two million change pages per year. About twenty percent of these change pages must be accomplished because of errors caused by misinterpretations between the users, content managers, and the editors. It currently requires more than 210 days to accomplish a TO change[2]. Additional time must be spent by the Using Command, to prepare and review the change request, before submitting it into the current TO system.

The current TO system is unable to effectively respond to user needs. Users from all functional areas of the current TO system indicate the system's inability to handle the increasing volume and complexity of technical data, which creates inefficiencies within the system, such as inaccurate data. Poor quality data has contributed to weapon system mishaps, leading to investigations that have documented a link between system accidents/incidents and inaccurate technical information.[3]

1.4 BENEFITS

The most significant benefits derived by implementing the proposed AFTOMS system are outlined in TABLE 1-1.[4] AFTOMS' greatest benefit is increased productivity associated with equipment maintenance and system management. Although productivity increases for other users would be realized, their use of TOs was considered to be occasional, could not be easily documented, and therefore, the benefits to be derived were not addressed within this study.

TABLE 1-1. AFTOMS SAVINGS BY FUNCTIONAL AREA

FUNCTIONAL AREA		CREATE	MANAGE	USE
COST DRIVER	Hardware			
	Software			
	Telecommunications			
	Facilities		• Warehousing	
	Personnel		• Productivity • Base Distribution	• Productivity
	Miscellaneous	• Acquisition • Review	• Printing • Mailing • TO Modifications	• Fuel/Payload

2. Refer to Appendix A, fact b.

3. A June 24, 1986 report by the Air Force Audit Agency stated that "aircraft accidents/incidents occurring since 1977 indicate that inaccurate technical data was determined to be contributing factors in 41 of 88 major aircraft accidents which resulted in equipment damage or loss". This data does not include those minor incidents where system damages or personnel injury costs were lower than the dollar threshold depicted in the Air Force Audit Report.

4. The benefits are derived by examining the potential savings in each of the specific functional areas in Table 1-1 of the TO life cycle. The current costs of each of the TO sub-functions is analyzed and the assumption that automation will decrease technical order costs, is the cornerstone used to calculate the potential benefits and cost avoidances.

1.5 REPORT ORGANIZATION

This Benefit Analysis Report describes the acquisition, review and management benefits, intangible benefits, and user benefits of AFTOMS and its ability to meet current and projected requirements of the United States Air Force (USAF). This report also describes the costs/benefits of AFTOMS compared to the current Air Force Technical Order process.

Section 2 presents acquisition, review and management costs associated with the current TO system, and the benefits of implementing AFTOMS to reduce these costs. Section 3, Intangible Benefits, describes those benefits that will be realized if AFTOMS is implemented, but cannot be easily quantified in monetary savings. User benefits with the implementation of AFTOMS is described in Section 4, User Benefits. Section 5, Summary, includes a summarization of the acquisition and management benefits, intangible benefits, user benefits and support costs with implemenation of AFTOMS. This section also includes a comparison of benefits versus costs of the current TO system and AFTOMS. The five appendices consist of reference material used in conducting the study and analysis of this report:

- Appendix A Facts and Assumptions
- Appendix B Mission Capable Rates
- Appendix C Technical Order Management Productivity Study
- Appendix D Active and Reserve Maintenance Personnel Strengths
- Appendix E User Technical Order Functions

SECTION 2: ACQUISITION, REVIEW, AND MANAGEMENT BENEFITS

The cost to create technical orders (TOs) include resources associated with planning, budgeting, reviewing and producing technical data. AFTOMS cost benefits are especially applicable in the areas of acquisition, management, review, productivity, mailings, warehousing, printing and the change process.

2.1 ACQUISITION COSTS

Each year the Air Force acquires approximately 4000 new TOs[5] containing an average of 150 pages. Thirty percent of the these TOs are for new weapon systems.[5] Presently the Air Force spends $1000 per page[6] to acquire a new TO. This cost includes engineering, editing, printing, and distribution costs. It is estimated that when AFTOMS is implemented, the cost to produce a new TO page will be reduced by 25%.[7] Since the contractor will deliver TOs in digitized form, there will be a reduction in preparation of masters, printing, distribution and editing manhours needed to create and deploy TOs.

The cost to produce new weapon system TOs is calculated as follows:

- Current Method -- 4000 X 30% X 150 X $1000 = $180.0M per year
- New Method -- 4000 X 30% X 150 X $750 = $135.0M per year
- Savings -- $180.0 - $135.0M = $45.0M per year
- Life Cycle Cost (LCC) savings -- $45M x 15 years = $675M

2.2 REVIEW COSTS

Each year Air Force personnel must review thousands of pages of new TOs to verify that the technical data is of sufficient quality to adequately support the equipment or weapon system. TOs are reviewed to ensure that the format is comprehensible, and that technical content (e.g., maintenance procedures, operating instructions, etc.) is accurate. The review process is extremely complex and time-consuming. Generally, contractors mail paper documents to several Air Force reviewers approximately thirty days prior to a formal review session. The review must be a team effort by the Air Force, because of the different levels of skills required to assess TO format, content, and considerations necessary for unique mission requirements. TABLE 2-1 summarizes the cost of performing TO reviews in FY88. The analysis considers travel costs and personnel travel days.

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5. Refer to Appendix A, assumption c.
6. Refer to Appendix A, fact d.
7. Refer to Appendix A, assumption e.

TABLE 2-1. TECHNICAL ORDER REVIEW PROCESS[8]

Organization	TDY expenditures FY88	Personnel days lost*
AAC	$7,300	12
AFSC	$1,310,000	1600
AGMC	$1,011	2
Air University	0	0
ATC	0	0
HQ AFRES	$23,098	180
HQ AFSC	$10,973	30
MAC	$16,385	63
OC-ALC	$193,956	502
OO-ALC	$21,124	69
SA-ALC	$91,092	733
SAC	$144,921	462
SM-ALC	$82,298	226
TAC	N/A	N/A
WR-ALC	$102,378	255
TOTAL	$2.0M	4,134

*for travel to and from the reviews only.

Although AFTOMS technology would not completely eliminate the need for face-to-face TO reviews, most Air Force TO administrators believe that review costs can be reduced. Conservatively, TO administrators estimate that review cost savings of at least 50% will be generated.[9] The average hourly salary for an E-5 is $18.43. This represents a cost of $609,520 per year. With the total cost of travel for the review process being $2.0M, AFTOMS would produce a savings of $1.3M annually based upon FY88 figures and a LCC savings of $19.5M ($1.3M x 15 yrs.).

2.3 MANAGEMENT COSTS

This section highlights the cost of managing TOs using the current TO system. Air Force management costs include costs incurred accomplishing the planning, developing, reviewing, distributing, printing, modifying, cataloging, and budgeting TO functions.

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8. Calculations used in TABLE 2-1: 4,134 x $18.43 x 8 = $609,520
($2.0M + .609M) x 50% = $1.3M

9. Refer to Appendix A, assumption f.

2.3.1 Productivity Costs

Substantial overall savings in labor costs are realized by automation. Studies have been completed which detail the percentage increases in worker efficiencies for all levels of jobs occurring in an office environment due to automation. The Booz-Allen & Hamilton study has contributed to this benefit analysis.[10]

Throughout the Air Force there are numerous personnel who manage the TO system: senior level personnel (5.3%), mid-level personnel (44.5%), and lower level personnel (50.2%) which consist of military, civilian and contractor workers at each level. Most of the staff work on TOs only part-time, with the remaining time spent on other logistical duties such as support equipment, spares, etc. Additionally, the TO workload fluctuates, causing the number of TO personnel to vary throughout the year. Many organizations/programs hire outside contractors to assist when the workload increases. The current total of TO management personnel in today's TO system is estimated to be approximately 3000 personnel.[11]

Productivity costs were estimated based on identification of TO activities, quantification of time savings, and estimation of annual cost of staff time.

2.3.1.1 Identification of TO Activities

The management activities which can benefit from automation include daily activities involved in the TO management functions: writing, revising, seeking information, seeking people, scheduling, filing/copying, waiting for work, traveling/other, face to face communication, telephone, reading, evaluating/calculating, and planning. (Refer to Appendix C, section 3.4).

2.3.1.2 Quantification of Time Savings

Quantifying management time savings involved tailoring the data from the cross-industry Booz-Allen & Hamilton Study to more specifically reflect the six key functional areas of TO management: change processing, review, development, distribution, printing, and planning. (Refer to Appendix C, section 3.1.2). The activity profiles, including documentation creation, administration, communications, and analysis, for each of these key functional areas, reflect time use for Senior, Mid-level and Lower-level staff. (Refer to Appendix C, section 3.3).

Once the profiles were developed for each functional area, a composite profile for each staff level was developed. (Refer to Appendix C, sections 3.2.2, 3.2.4, and 3.2.6). This entailed

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10. The 1983 Booz-Allen & Hamilton study was based on time and motion studies for 15 different government and commercial organizations. Over 75,000 time samples were collected from over 300 white collar workers to generate the work force statistics dealted in Appendix C. This study was chosen because it was the most recent and comprehensive study, as well as being the most conservative in terms of estimated time savings. The data in the Booz-Allen & Hamilton study also identified potential improvements in productivity. Refer to Appendix C for the findings of this study as it applies to the Air Force TO process.

11. Refer to Appendix A, fact g.

weighing the activity profiles with each activity's percentage of the total TO management effort. The percentage of time each composite spent on TO activities was multiplied by the potential time savings for each activity to estimate the percentage of total time that could be saved by each staff through automation. (Refer to Appendix C, sections 3.2.1, 3.2.3, and 3.2.5).

2.3.1.3 Estimation on Annual Cost of Staff Time

An estimation on the annual cost of staff time spent on each functional area of TO management was performed. This required estimating the composition of TO management staff by military, civilian, and contractor personnel. (Refer to Appendix C, section 3.1.1). Air Force officers and enlisted personnel, as well as civilian Air Force personnel, each consist of approximately 45% of TO management staff. The remaining 10% of TO management staff consists of contractor personnel. FIGURE 2-1 illustratrates this breakdown.[12]

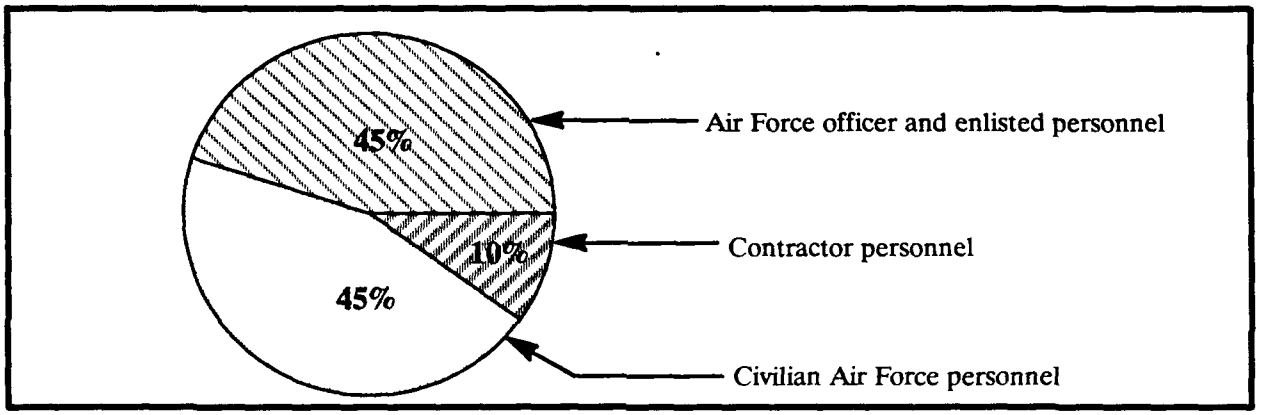

FIGURE 2-1. ESTIMATED TECHNICAL ORDER MANAGEMENT STAFF COMPOSITION

Compensation for each staff level in each labor component was developed to include benefits and applicable allowances from the annual pay scales in AFR 173-13. Senior-level had a military average at the 0-5 level, and a civilian average at GM-15. Mid-level had a military average at E-6, and a civilian average at GS-12. Lower-level had a military average at E-4, and a civilian average at GS-6.

Once the compensation was weighed by labor category and totalled, the annual loaded cost for each staff member (Military, Civilian, and Contractor) at the Senior, Mid and Lower level was estimated with the following results: Senior--$54,038, $63,473, and $150,000; Mid--$37,954, $29,223, and $87,500; Lower--$24,230, $18,103, $50,000; (See TABLE 2-2). Since these staff levels are not employed at the same salary rates, provision for staff utilization was necessary.

This was accomplished by estimating the Senior, Mid and Lower level participation in each TO function and weighing that participation by the percentage of total TO effort that each

12. Refer to Appendix A, assumption h.

function represented. For example, the split between Senior, Mid and Lower level staff for change processing is 10%, 40%, and 50%, respectively. Since change processing represented 30% of the total effort, the Senior staff participation in the total TO effort attributable to change processing is 3% (10% x 30% = 3%).

TO management cost reduction predictions were estimated for the six functional areas: change processing, review, development, distribution, printing, and planning. This estimation included Senior, Mid and Lower staff levels made up of Military, Civilian and Contractor personnel. TO Management Cost Reduction computations in TABLE 2-2, show that automating the TO management areas results in an estimated $25 million per year projected savings in productivity improvements.[13]

TABLE 2-2. TO MANAGEMENT COST REDUCTION PROJECTIONS

TO STAFF COMPOSITION	SALARY/YR	NO. OF PERSONNEL	TOTAL SALARY (Salary/Yr x No. of Personnel)
SENIOR-LEVEL (5.3%)[14]			
Miltary	$54,038	72 (45% x 160)	$3,891,000
Civilian	$63,473	72 (45% x 160)	$4,570,000
Contractor	$150,000	16 (10% x 160)	$2,400,000
TOTAL		160	$10,861,000
MID-LEVEL (44.5%)[14]			
Miltary	$37,954	600 (45% x 1335)	$22,772,000
Civilian	$29,223	600 (45% x 1335)	$17,534,000
Contractor	$87,500	133 (10% x 1335)	$11,638,000
TOTAL		1333	$51,944,000
LOWER-LEVEL (50.2%)[14]			
Miltary	$24,230	678 (45% x 1506)	$16,428,000
Civilian	$18,103	678 (45% x 1506)	$12,274,000
Contractor	$50,000	150 (10% x 1506)	$7,500,000
TOTAL		1506 (50.2% x 3000)	$36,202,000

STAFF	TOTAL SALARY	x HOURLY SAVINGS[15]	= TOTAL
Senior-Level	$10,861,000	15.02%	$1.63M
Mid-Level	$51,944,000	21.51%	$11.17M
Lower-Level	$36,202,000	32.94%	$11.92M
TOTAL PROJECTED ANNUAL SAVINGS			**$24.7M**

13. In TABLE 2-2, each percentage of staff levels (Senior, Mid and Lower), was multiplied by 3000 (total personnel in TO system). The resulting total for each level is identified in the "No. of Personnel" column. The total no. personnel for each level was multiplied by the percentage of staff composition for each category (45%x Total No. of Personnel for Military, 45% x Total No. of Personnel for Civilian, 10% x Total No. of Personnel for Contrator) to obtain the no. of personnel for each category (Military, Civilian, Contractor). The no. of personnel for each category was multiplied by the respective salary/yr to get total salary for all personnel in each category (Total Salary column). Military, Civilian & Contractor salaries for each level were added to get the tota.l salary of all personnel in each level. The Senior, Mid and Lower Level salaries were multiplied by the hourly savings (percentages taken from the Booz-Allen & Hamilton study), to get the resulting total dollars of projected savings for each level. These total dollars were added to get the TOTAL PROJECTED SAVINGS of 24.7M.

14. Refer to Appendix A, fact m.

15. Refer to Appendix A, assumption n.

2.3.2 Mailing Costs

The Air Force Logistics Command (AFLC) mailing cost for FY87 was $1.2M[16] to mail TOs and associated changes, supplements and revisions to all users through the U.S. Postal Service. The savings to be achieved in mailing costs by automation and digitization of technical data will result at the rate of 6.6% per year to a maximum of 90%.[17] The LCC benefits will result in a $11.2M savings.

2.3.3 Warehousing Costs

Warehouse operating costs are approximately $3.2 million annually.[18] (This does not include the cost of operating the TO Repository at the Oklahoma City Air Logistics Center (OC-ALC)).

Warehouse space saving resulting from digitization will accrue at the rate of of 6.6% per year.[18] No space savings would be achieved until at least 50% of the TOs[19] were digitized.

Since warehouse space construction currently cost AFLC $50.00 per square foot[20], and 90% of the current space used for TO storage (350,000 sq. ft.)[18] can eventually be used for other functions, a cost avoidance will result in the amount of $15.75M ($50.00 x 90% X 350K = $15.75). Warehouse operating cost savings will result in a Life Cycle Cost (LCC) of $24.8M.[17]

2.3.4 *Printing Costs*

The most current printing cost data available was for FY88 totalling $10.1M. Under AF-TOMS, presentation will be accomplished on demand, either by electronic display or printed by the users.[21]

AFLC (EEIC 501):	$6.61M[22]
AFSC (EEIC 501):	$3.50M[23]
TOTAL:	**$10.1M**

The indicated LCC is calculated to be $93.9M.[17]

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16. Refer to Appendix A, assumption i.
17. Refer to Appendix A, assumption j.
18. Refer to Appendix A, assumption k.
19. Refer to Appendix A, fact l.
20. Refer to Appendix A, fact o.
21. Refer to Appendix A, assumption p.
22. Refer to Appendix A, fact q.1.
23. Refer to Appendix A, fact q.2.

2.3.5 Change Costs

The process of TO modification due to errors or equipment design changes is complex, time consuming, and extremely expensive. There are over 23 million unique pages in the Air Force TO inventory.[1] Two million three hundred thousand (10% of total) change pages were produced in FY88.

A direct savings will result from the implementation of AFTOMS. AFTOMS will link users at the bases, AFLCs, and AFSCs to a communications network, allowing managers and maintainers on-line access to the TO system. With AFTOMS in place, the ALCs, and acquisition SPOs will have the capability to review TOs while they are in a developmental, pre-delivery stage. The result will be a 15% reduction in the number of changes required after distribution. The network will facilitate the rapid collection and analysis of TO trouble reports as well as the aggregation of more change material into each revision, resulting in fewer modification cycles. This will further reduce the overall number of changes by at least 5%. Therefore, the overall reduction of TO changes resulting from implementation of AFTOMS is expected to be a minimum of 20% (15% + 5% = 20%), beginning in 1994. FIGURE 2-2 illustrates the change reduction as a result of the implementation of AFTOMS.

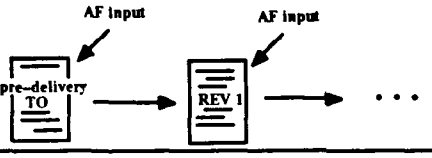
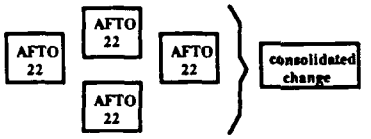
Factor	Process	Result	Total
pre-delivery inspection		**15%** less changes post-distribution	**20%**[24] less changes
on-line TO network		**5%** less changes by aggregation	

FIGURE 2-2. CHANGE REDUCTION AS A RESULT OF AFTOMS

Certain assumptions were made to determine the costs benefits associated with modifying TOs:

- Total annual TO change pages = 2.3M pages[1]
- Average annual AFLC change page production costs = 27.5M[25]
- Reduction in changes due to automation = 20% (See FIGURE 2-2)
- Cost per contractor page = $27.5M divided by 2.23M pages

24. Refer to Appendix A, assumption r.
25. Refer to Appendix A, fact s.

Of the total number of 2.3M change pages produced, 80% are contracted to the prime contractors, and 20% are accomplished by the ALCs using overflow contractors and government personnel.[26] The total number of TO change pages produced by prime contractors and in-house personnel is outlined in TABLE 2-3.

TABLE 2-3. NUMBER OF TECHNICAL ORDER CHANGE PAGES[1]

PRIME CONTRACTORS:		1,840,000 pages
IN-HOUSE PERSONNEL:		
(Overflow Contractors:	388,000)	
(Government personnel:	72,000)	460,000 pages
TOTAL CHANGE PAGES:		2,300,000 pages

Computations for savings assume full implementation in 1994, at which time dollar savings begin to accrue. Categories of savings include elimination of changes and reduction of change production costs. The basic premise is that, by 1994, the current rate of conversion of the paper TOs (6.6%+ per year, beginning in 1990) will continue at least at that rate, and after 1994, all new data will be delivered in digital format.[27]

Contractor change production cost is accomplished by the prime and overflow contractors and is based upon data received from HQ AFLC/DAP. The organic change production costs are based upon San Antonio Air Logistics Center (SA-ALC) personnel strengths, believed by the AFTOMS System Program Office (SPO) to be most representative of the standard personnel strengths that will be developed for all the ALCs.

2.3.5.1 Personnel Costs

On average, overhead personnel divide time spent on TOs among engineering data service functions, such as the Engineering Data Computer Aided Retrieval System (EDCARS) facility and the manual Engineering Data Service Center (EDSC). For every hour spent by the technical staff on TOs, a half hour of overhead personnel time is also spent (1 hr. technical time per 1/2 hr. overhead time spent on TOs). TABLE 2-4 and TABLE 2-5 define overhead and technical personnel costs.

---

26. Refer to Appendix A, fact t.

27. Refer to Appendix A, assumption v.

TABLE 2-4. AFLC OVERHEAD PERSONNEL COSTS[28]

POSITION	GRADE	NO. OF PERSONNEL	RATE/HR
Supervisor	GS-12	1	$29.60
System Manager	GS-11	1	$24.41
		TOTAL:	$54.01

Average Rate/Hr: $27.00
Pro Rata (1 hr. technical time per 1/2 hr. overhead time spent on TOs): $13.50

TABLE 2-5. AFLC TECHNICAL PERSONNEL COSTS[28]

POSITION	GRADE	NO. OF PERSONNEL	RATE/HR	TOTAL RATE/HR
Lead Illustrator	GS-11	1	$24.41	$24.41
Illustrator	GS-09	1	$20.23	$20.23
Text Editors	GS-07	4	$16.52	$66.08
			TOTAL:	$110.72

Average Rate/Hr: $18.45

The applicable personnel hourly rate for in-house production and/or conversion of paper formatted TOs to digital format, suitable for creation of the change to be made, would be:

> Pro Rata Overhead Personnel Costs + Technical Personnel Costs = Average Overhead and Technical Personnel Costs per Hour; or
>
> $13.50 + $18.45 = $31.95

Both changes and digital conversion are done by the same personnel using the same equipment.

2.3.5.2 Average In-house Costs

It takes approximately 24 minutes (.4 hours) to create a change, and an additional 30 minutes (.5 hours) to convert a TO from paper to digital format[29]. If data was previously digitized, the average cost of an in-house produced change would be:

> Hours/Minutes to Create a Change x Average Overhead and Technical Personnel Costs per Hour = **Cost of In-House Produced Change**; or
>
> .4 Hours x $31.95 = **$12.78**

28. Refer to Appendix A, fact u.
29. Refer to Appendix A, fact w.

The ALCs stated that it requires from five minutes to one hour ten minutes (avg. 24 min.) to effect the change, depending on the amount of graphics and/or tables on each page.

If the data is in paper format, it must be converted to digital format before the change can be produced. The cost of converting the paper-formatted data to a digital format would be:

> Hours/Minutes to Convert Paper to Digital Format x Average Overhead and Technical Personnel Costs per Hour = **Cost of Converting Paper Format to Digital Format**; or
>
> .5 Hours x $31.95 = **$15.97**

The total cost of creating a change page from a paper-formatted TO would be:

> Cost of In-House Produced Change + Cost of Converting Paper Format to Digital Format = **Cost of Creating a Change Page from a Paper-Formatted TO**; or
>
> $12.78 + $15.97 = **$28.75**

In summary the average in-house cost to create a change page from a paper formatted TO to a digitized TO would be $28.75.

2.3.5.3 Reduction in the Number of Changes

The implementation of AFTOMS would provide a reduction in the number of changes to TOs, resulting in significant cost savings. Refer to FIGURE 2-2 and TABLE 2-3 for values in the following cost saving formulas:

- Contracted change savings:

> No. of Change Pages (Prime Contractors + Overflow Contractors) x % Reduction in Changes due to Automation x Net Contractor Cost per Page = **Total Annual Cost Reduction in Number of Changes**; or
>
> 2,230,000 x 20%[30] x $12.30 = **$5,49,000/Year***
>
> * These are production costs and do not include government contract administration costs.

---

30. Refer to Appendix A, assumption x.

- In-house change savings:

  No. of Change Pages (Government Personnel) x % Reduction in Changes due to Automation x Net In-House Cost per Page = **Total Annual Cost Reduction in Number of Changes**; or

  72,000 x 20%[30] x $28.75 = **$414,000/Year**

- Total contract and in-house savings associated with elimination of 20% of TO changes would be:

  Total Annual Costs Reduction for Contractor + Total Annual Costs Reduction for In-House = **Total Savings Associated with TO Changes**; or

  $5.49M + $.41M = **5.9M/Year;**
  and LCC savings of $88.5M ($5.9M x 15 yrs)

2.3.5.4 Change Process Cost Savings

The following analysis is used in determining the total annual cost savings in producing TO change pages:

- Current in-house and contract change costs to produce the total TO change pages each year are as follows:

  Present Contractor: 2.23M change pages (Prime Contractors + Overflow Contractors) x $12.30 (Cost per Change Page) = **$27.0M/Year**

  Present In-House: 72,000 change pages (In-house Government Personnel) x $28.75 (Cost of Creating and Converting a Change Page) = **$2.1M/Year**

  Summary: $27.0M + $2.1M = **$29.1M** to produce TO change pages each year under the current method.

- After AFTOMS implementation the costs to produce the total changes pages each year will be as follows:

  New Contract: 1,840,000 change pages (Prime Contractors) x 50%[31] x $12.30 (Cost per Change Page) = **$11.1M** to produce TO change pages each year under the new method.

31. Refer to Appendix A, assumption y.

- The total annual cost savings to produce TO change pages each year is computed using the following formula:

  Annual Cost to Produce Change Pages with Current Method – Annual Cost to Produce Change Pages with New Method = **Total Annual Savings in Cost of Changes Pages**; or

  $29.1M – $11.1M = **$18.0M/Year Total Annual Savings**

  - TO changes do not require the basic TO page itself to be digitized prior to effecting the change;
  - On–line review can be accomplished;
  - It does not require a repro–master to be produced, etc.
  - It is assumed that a 50% reduction in costs can be achieved after AFTOMS is implemented and the TOs are digitized, because of on–line reviews, on–line change capabilities, no requirement for masters, etc.

  This results in a LCC savings of **$169.2M.**[17]

SECTION 3: INTANGIBLE BENEFITS

3.1 GENERAL MAINTENANCE

Intangible benefits represent those savings that will be realized, but because of their very nature, cannot be easily quantified in monetary savings. These benefits of the TO automation are difficult to measure, but will contribute significantly to the mission accomplishment and effectiveness of the Air Force. These intangible benefits include:

- More accurate technical data;
- Reduced TO change turn around times;
- Standardized TO formats:
  - Reduced familiarization time,
  - Reduced TO acquisition lead time;
- Aircraft will carry all relevant TOs on-board for use if a malfunction occurs away from the home base, resulting in increased readiness through reduced, not mission capable, time;
- Better maintenance due to more accurate user friendly TOs, leading to fewer aircraft mishaps;
- Reduced mobility costs:
  - Less aircraft equivalents needed for mobility because of elimination of paper TOs (cubic/weight);
- Reduced TO printing time:
  - Print on-demand or display visually at work site,
  - Replace pages instead of entire TOs;
- Improved Maintenance Data Collection (MDC) Data:
  - Use inactive links to maintenance code manuals and input to MDC system;
- Improved Spares Requisition:
  - Improved accuracy of requisitions,
  - Reduced spares acquisition time because of improved forecasting;
- Reduced paper work:
  - Eliminates filing TO changes,
  - Eliminates manual preparation of MDC data;
- Improved fault isolation and repair actions;

- Reduced weapon system and equipment mishaps because of more accurate and timely data;
- Improved TO delivery time. TOs will be delivered faster since the time from AFTO22 submittal to having the change in-house will be reduced considerably.

3.2 INTERIM CONTRACTOR SUPPORT (ICS) AND FLIGHTLINE DELAYS

In addition to reducing costs to create TOs, several contractors have demonstrated that automation also reduces the time required to produce a new TO. Automation makes it easier to ensure that the content is correct and that formatting requirements are satisfied. The existing TO system in many cases does not produce TOs on time. They are often not available when equipment is delivered. This may cause the following problems:

- Delays in being able to use and maintain the equipment, which reduces readiness and increases costs;
- Increased likelihood of ICS, with contractors performing maintenance until the TOs are delivered (very costly);
- Delays in conducting training for Air Force personnel to operate and maintain the equipment.

SECTION 4: USER BENEFITS

This section describes user benefits with implementation of AFTOMS. It assumes that a user presentation system will be implemented and a majority of the current weapon system's TOs will be digitized.

The user benefits gained from automation include the following: (1) Labor Productivity Improvements, (2) Increased Aircraft Availability/Mission Capable Rates[32], (3) MAC Cargo Aircraft Operational Fuel and Weight Savings, and (4) Reduced User Distribution Costs. Although many more benefits are possible, only these four are documented as major benefits.

Air Force TO users are often occupied with TO related management efforts rather than operating and maintaining the equipment. Estimates of personnel time spent dealing with TO system inefficiencies range from one day to 15 weeks per annum. TO system inefficiencies include the following:

- TOs are not readily available when needed, and sometimes have to be ordered through the Technical Order Distribution Offices (TODO) or borrowed from another organization;
- Difficulty in initially locating information within the TO;
- Cross–referencing problems;
- Ordering/registration/distribution problems;
- Performing inaccurate procedures;
- Processing AFTO22 TO change requests;
- Posting changes and replacing pages.

TO inefficiencies associated with the TO management process are a major reason for unproductive time. Other factors detracting from productive users include: inadequate tools, facility shortcomings, and administrative problems (supply, training, work orders, etc.). These factors are not specifically quantified but are presented in FIGURE 4-1 to draw attention to their impact on maintenance productivity. Although TO users encompass the entire spectrum of the TO process (Appendix E), the benefits depicted in this portion of the analysis only address maintenance functions. Increased productivity in the TO management process would also benefit the occasional user, however additional effort is needed to evaluate these functions such as, operations, engineering, medical, etc.

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32. Refer to Appendix B for Mission Capable Rates/Aircraft Availability Improvements.

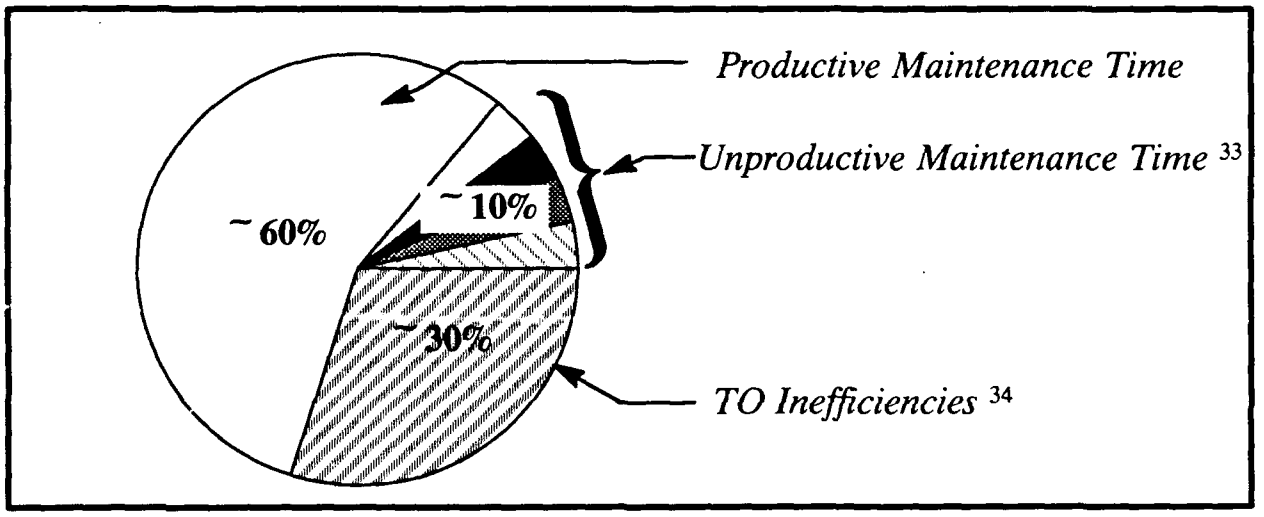

FIGURE 4-1. MAINTENANCE PRODUCTIVITY FACTORS

4.1 BASE LEVEL DISTRIBUTION OFFICE

The TODOs currently fulfill a critical function for the Air Force Using Commands. There are currently 3154 TODO on Air Force bases. The TODO is the interface between the users and the managers of the Air Force TO system, and is responsible for requisitioning, filing, inventorying, reporting changes and distributing TOs. According to a January 1986 report by the Air Force Logistics Management Center (AFLMC), the Air Force currently spends upwards of $58 million for the TODO system.

The AFLMC report concluded that a $61 million savings would be realized when an automated computer program is used to simplify the TODO inventorying, requisitioning, distributing, etc. Using the AFLMC report and updating the data for actual number of TODOs (3154) personnel equivalents, it was determined that a savings of $55.17M per year can be realized with a LCC of $717.5M.[35] Refer to TABLE 4-1 for the computation in estimating the TODO cost reduction.

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33. Unproductive maintenance time includes the following: inadequate tools; facility shortcomings; administrative (supply, training, work orders, etc.); and other factors (poor design, inadequate training, etc.).

34. Refer to Appendix A, assumption z.

35. Refer to Appendix A, assumption aa.

TABLE 4-1. TECHNICAL ORDER DISTRIBUTION OFFICE COST REDUCTION

TODO - CURRENT MANUAL SYSTEM	TODO - AFTER AUTOMATION
10 Minutes/Transaction	3 Minutes/Transaction
x 125 Transactions/Week	x 125 Transactions/Week
x 52 Weeks	x 52 Weeks
÷ 60 Minutes	÷ 60 Minutes
x $18.43 Per Hour Cost	x $18.43 Per Hour Cost
x 3154 FTEs[36]	x 1305 FTEs[37]
=A. $ 62.97M	**=B. $ 7.8M**
A - B = $55.17 M/YEAR	

4.2 USER PRODUCTIVITY

User productivity was limited to the civilian and enlisted maintenance Air Force Specialty Codes (AFSCs), since they were considered to be the prime users of technical data on a frequently recurring basis. The personnel strengths depicted below were extracted from HQ USAF manpower documents and are detailed in Appendix D by AFSC. Officer AFSCs and remaining enlisted and civilian AFSCs are not included in the the active-duty and reserve personnel strengths depicted below because of infrequent TO usage and/or lack of documentation as to the amount of time spent using and searching for technical data.

Active Duty

- There are 134,410,958M maintenance hours available each year. This represents 214,429 active duty maintenance personnel x 1,741.2 available hours per year x 60% of personnel involved in repair actions x 60% of the time spent in direct labor;[38]
- Thirty percent of maintenance hours are used researching TOs -- 40,323,287 per year;[39]
- Twenty-five percent of the hours can be saved through automated TOs—10,080,821 per year;[40]
- Therefore, 5,880.7 active duty manyear equivalents can be saved (4681 personnel are military and 1199 are civilian) for a cost savings of $173.8M per year.

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36. For the TODO current manual system, figures for Minutes/Transactions, Transactions/Week, and Cost/Hour taken from the January 1986 AFLMC report by Mr. Cecil House. Figures have been updated to reflect manning and cost levels for 1988.

    Each TODO utilizes one personnel equivalent to operate. The TODO processes 125 transactions per week multiplied by 10 minutes per transaction for 52 weeks. The resulting value is multiplied by the hourly wage. For FTE figure on TODO current manual system, refer to Appendix A, fact bi.

37. AFTOMS reduces the transaction time to three minutes and the number of TODOs to 1305 (261 CTODO + 1044 TODOs). Refer to Appendix A, assumption ab.

38. Refer to Appendix A, facts ac and ae; assumptions v and ad.

39. Refer to Appendix A, assumption af.

40. Refer to Appendix A, assumption ag.

Reserve Forces (Air Force Reserve Forces (AFRES) and Air National Guard (ANG))

- There are 4,752,,288M reserve maintenance manhours available each year. This represents 58,000 maintenance personnel x 227.6 available hours per year x 60% (of personnel involved in direct labor) x 60% (involved in maintenance repair tasks);[38]
- Thirty percent of the maintenance hours are used researching TOs--1,425,288 per year;[39]
- Twenty-five percent of the hours can be saved through automated TOs--356,421 per year;[40]
- Therefore, 1,566 reserve personnel equivalents can be saved for a cost savings of $4.7M per year.

Overall, the productivity gains for the active and reserve forces result in a yearly savings of $178.5M and a LCC savings[41] of $1.4B. Productivity cost savings can also be directly related to *Improved Mission Capable Rates and Aircraft Availability* (Refer to Appendix B). This savings in productivity cost results from reduced manhours per flying hours because of improved fault isolation, using and ordering of correct parts, improving spares requisition, etc. This also results in less ground and turn-around time for each aircraft.

4.3 MISSION CAPABLE RATES

Mission capable rates represent the time in hours that a weapon system is available or capable of performing its assigned mission. A weapon system is mission capable when all maintenance actions are complete. The goal of Air Force maintenance is to maximize the number of hours aircraft are Mission Capable (MC). An MC aircraft is able to perform **all** of its primary assigned Air Force missions. When an aircraft cannot perform Air Force missions, it is for two reasons: supply problems (Not Mission Capable Supply, NMCS) or the system is undergoing maintenance (Not Mission Capable Maintenance, NMCM). Both NMCS problems and NMCM problems can be caused by inefficiencies in the TO process. High NMCM and NMCS rates detract from the capability of the Air Force to perform its assigned missions. In critical situations, as well as with the normal daily mission requirements, the Air Force is confronted with equipment shortages making it important to maximize the availability of its resources. In the costing exercise outlined below, conservative estimates are made in order to quantify the costs of aircraft shortages in critical situations.

The Air Force has approximately 9,349 aircraft, including AFRES and ANG assets.[42] (Refer to Appendix B for selective primary aircraft used in determining the increase of MC rates).

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41. Refer to Appendix A, assumption ah.
42. The numbers of aircraft used in this costing exercise are intended to illustrate the magnitude of the costs involved and do not represent the total Air Force (active and reserve) aircraft inventory.

It is assumed that at any given time the Air Force has about 20% or 1870 aircraft unavailable for flight, due to logistics reasons. A conservative estimate on the average cost of one new (replacement) aircraft to compensate for an aircraft Not Mission Capable (NMC) is $50 million with an average aircraft life cycle of 20 years. This translates to a cost of $2.5 million per year per aircraft. The formula depicted below is used to determine the increased mission capable rate for the selected aircraft. Similar mission capable rate increases could be realized for the remaining Air Force aircraft inventory.

- Number of aircraft x 24 hrs x 365 days = Available Aircraft Hrs per year (Avail A/C Hrs).
- Available aircraft hrs x Mission Capable Rate = Original MC Hrs (MC Hrs O)
- Maintenance manhours/flying hr x flying hrs = Maintenance Manhours Expended (MMHrs E).
- Maintenance manhours expended x 30% (hours expended researching TOs)[39] x 25% (savings from automation)[40] = Maintenance Manhours Improvement (MMHrs I).

$$\frac{\text{MMHrsE}}{\text{MC Hrs O}} = \frac{\text{(MMHrs E + MMHrs I)}}{\text{New MC Hrs (MC Hrs N)}}$$

$$\text{MC Hrs N} - \text{MC Hrs O} = \text{MC Hrs Increase (MC Hrs I)}$$

$$\frac{\text{MC Hrs I}}{\text{Avail A/C Hrs}} = \text{MC Rate (\% Increased)}$$

The improved workforce productivity (MMHrs I) results in more maintenance manhours to be applied to repairing aircraft, missiles, etc., thus translating to increased mission capable rates. This examination was performed for each aircraft type listed in Appendix B.

4.4 AIRCRAFT AVAILABILITY

Digitization of the TOs permits users to easily move from one TO reference to another. It permits them to easily locate the proper work steps, and can be tailored to present all the information that is needed to accomplish a specific task. This will result in more accurate and productive maintenance; therefore, resulting in an average maximum MC rate increase of 5.8% and minimum of 1.5%. The two extremes considered here make it clear that the savings through full automation of the user levels will be substantial. If the MC rate increase is extrapolated to increased available aircraft, the savings can be portrayed even more dramatically. Conservatively, applying the MC rate increase of 1.5% will result in 81 additional selected aircraft per day or a cost avoidance of $202.5M per year. Percentages of MC rates and availabilities are portrayed in FIGURE 4-2.

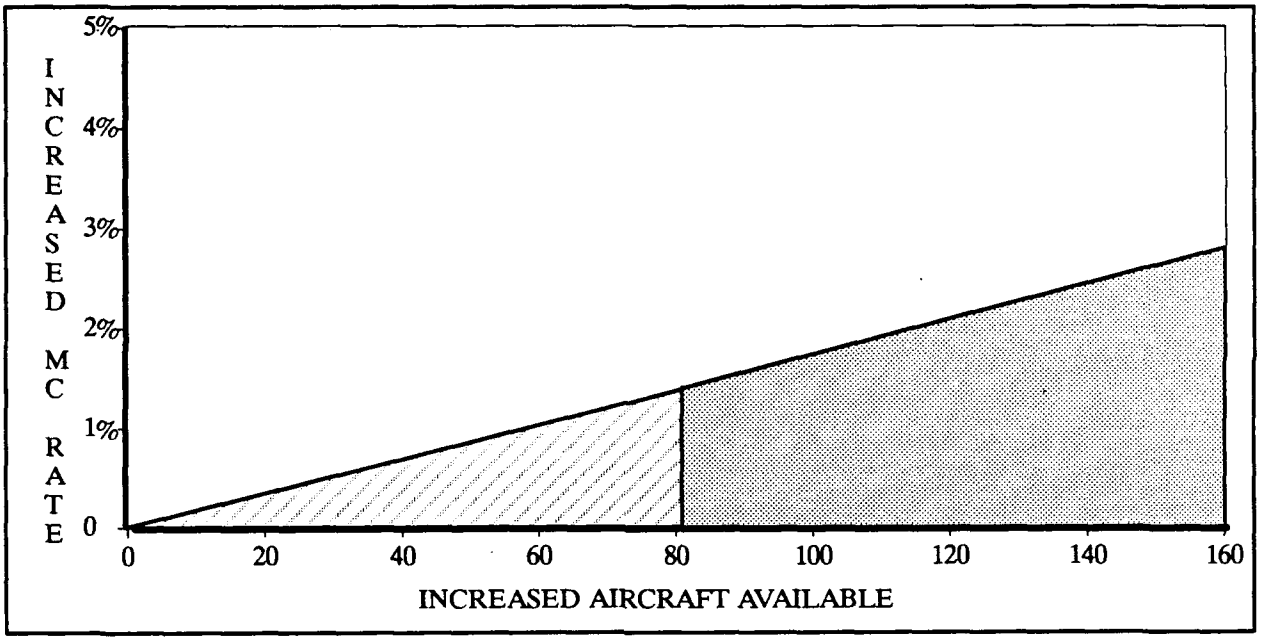

FIGURE 4-2. SELECT AIRCRAFT MISSION CAPABLE RATES & AVAILABILITIES

MC rates and aircraft availability improvement data for selected aircrafts are contained in Appendix B. The following formula is used to determine the increase in aircraft availability.

$$\frac{\text{MC Hrs I}}{\text{(1 A/C x 24 hrs x 365 days)}} = \text{Increased Aircraft Availability}$$

4.5 FUEL/PAYLOAD COSTS

Some Using Commands currently carry TOs on-board their larger aircraft. This takes up valuable airlift capabilities and results in additional fuel consumption. These airborne TOs can weigh up to several hundred pounds per aircraft. There is significant potential cost avoidance to be gained by eliminating paper TOs on-board aircraft. Similar savings can also be applied to any airlift or bomber type aircraft presently carrying an on-board G-File. The fuel savings can be determined by using the following facts and formula:

- Weight savings from eliminating paper TOs on-board MAC aircraft: C-141--150lbs; C-130--180lbs; C-5--410lbs and the C-17--1000lbs.[43]
- HQ MAC/DOV has determined the fuel saving factor per pound of cargo to be: C-141--4.7%, C-130--5.2%,and C-5--3.5%.[44]

43. Refer to Appendix A, facts ai, aj, ak, and al.
44. Refer to Appendix A, fact am.

- AFSC ASD/C-17 SPO studies indicate that digitization of the C-17 G-File will result in life cycle fuel saving of $17M.[45]

- On-board optical reader and associated computer hardware is estimated to weigh 50lbs.[46]

- Calculated fuel savings: (TO Weight x Flying Hours Fuel Factor x Cost per Gallon of Fuel)

  - C-130 Aircraft
    130lbs (180lbs-50lbs) x 292,785 hrs per year x .052 X .61 = $185,742 per year

  - C-141 Aircraft
    100lbs (150lbs-50lbs) x 282,651 x .047 x .61 = $124,670 per year

  - C-5 Aircraft
    370lbs (420lbs-50lbs) x 59,452 x .035 x .61 = $72,200 per year

- Total fuel savings per year for MAC cargo aircraft (does not include the reserves) is $0.19M per year for (C-130, C-141, and C-5). The C-17 will generate a savings of $17M over the aircraft life cycle or $0.83M per year.

MAC cargo aircraft will save approximately $1.2 million annually in fuel costs for their active force cargo aircraft. In addition, there are approximately 7200 non-cargo aircraft in the Air Force which would also benefit from the elimination of transporting paper TOs during flight and/or during contingency and exercise deployments. (These savings were not calculated or included in the net fuel savings. However they do appear as intangible savings/benefits. Refer to Section 3, Intangible Cost Benefits).

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45. Refer to Appendix A, fact al.

46. Refer to Appendix A, assumption an.

SECTION 5: SUMMARY

The cost of the current Air Force TO process is extremely high. The time required to produce new manuals and change pages is increasing. Manuals are becoming larger, costlier, more complex, and more difficult to use. Air Force personnel are increasingly unable to manage the paper-based system effectively. Limited automation has taken place at the lowest organizational levels, and has correspondingly received limited results. Full automation will bring significant results by improving the accuracy, completeness, timeliness, currency, and ease of using TOs.

The cost of AFTOMS may exceed the $250M presently budgeted, since additional bases are necessary and since current paper based TOs must be digitized. Digitizing TOs is estimated to cost approximately an additional $20 to $30M. (More precise cost data will be available upon completion of the AFTOMS TO Conversion Proof-of-Concept (POC) effort). A fully implemented AFTOMS has enormous impacts in dollars saved, productivity improvements, cost avoidance, and intangible benefits to the Air Force.

5.1 ACQUISITION, REVIEW AND MANAGEMENT BENEFITS

The benefits associated with the implementation of AFTOMS at the management and administration levels (Tiers 1, 2, and 3) assume that weapon system TOs will be digitized at the rate of 6.6% per year. TABLE 5-1 summarizes acquisition, review and management cost benefits.

TABLE 5-1. ACQUISITION, REVIEW AND MANAGEMENT BENEFITS

BENEFIT	YEARLY	LCC	COST AVOIDANCE
Technical Order Printing	$10.0M	$93.9M	
Technical Order Mailing	$1.2M	$11.2M	
Management Productivity Improvement	$24.7M	$321.0M	
Technical Order Change Process:			
Reduce Number of Changes	$5.9M	$88.5M	
Change Process	$18.0M	$169.2M	
Technical Order Review Process	$1.3M	$19.5M	
New Technical Order Acquisition	$45.0M	$675.0M	
Warehousing:			
Operational Costs	$3.2M	$24.8M	
Space			$15.8M
TOTAL	$109.3M	$1.403B	$15.8M

The overall monetary benefits for management and administrative functions resulting from the implementation of AFTOMS would be approximately **$1.4B** over the system life cycle. Additionally, there would be a **$15.8M** cost avoidance for new construction.

5.2 USER BENEFITS

If dollars are available in FY89 to begin digitization of all major weapon system TOs, user benefits will begin accruing in 1994. It further assumes that 90% of these TOs will be digitized at the rate of 6.6% per year beginning in 1989. The overall monetary benefits to the users resulting from the implementation of AFTOMS is conservatively estimated at **$2.1B** over the system 15 year life cycle. Additionally, digitization of the TOs will increase worker productivity, therefore, resulting in increased mission capable aircraft and increased aircraft availability. This will result in a minimum of 81 additional aircraft per year and an LCC avoidance of **$4.05B**. TABLE 5-2 summarizes the user benefits.

TABLE 5-2. USER BENEFITS

BENEFIT	YEARLY	LCC	COST AVOIDANCE
Fuel Savings MAC Airlift Aircraft	$1.2M	$20.4M[49]	
Base Level TODO Function	$55.17M	$717.5M	
Maintenance Productivity Improvement	$178.5M	$1.4B	
TOTAL *	**$234.8M**	**$2.137B**	
Aircraft Mission Capable Rate Increase[47]	1.5--5.8%		
Aircraft Availability Increase			
Twenty-five percent level[48]	81 A/C		$4.05B (LCC)
Fifty percent level[48]	162 A/C		$8.1B (LCC)

* Does not reflect aircraft availability savings.

5.3 BENEFITS SUMMARY

FIGURE 5-1, Projected LCC Savings, depicts the gross estimated savings of an automated AFTOMS for users and managers, over a 15 year life cycle.

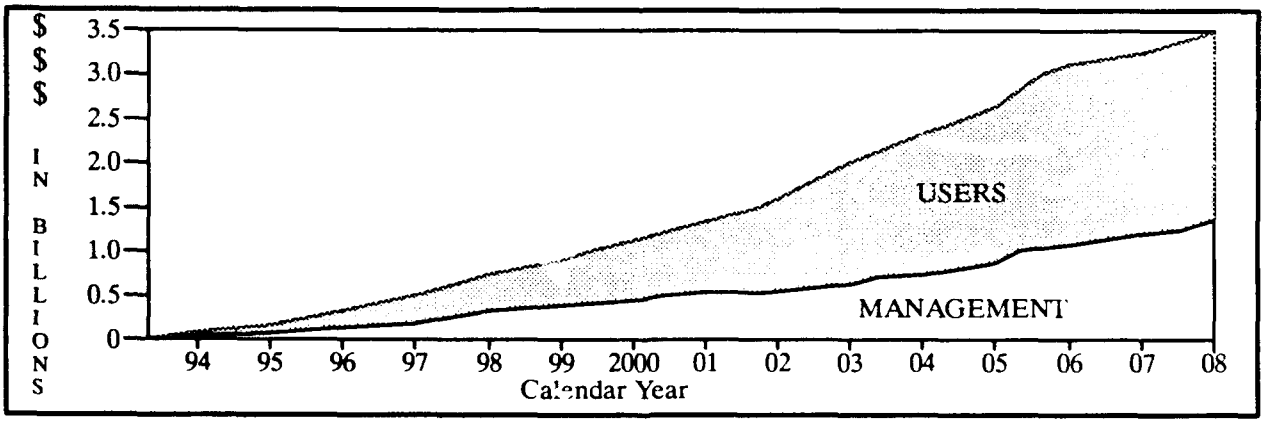

FIGURE 5-1. PROJECTED LIFE CYCLE COST SAVINGS[50]

47. Refer to section 4.4 and Appendix B of this report.
48. Refer to Figure 4-2 and Appendix B of this report.
49. Refer to section 4.5 of this report.
50. Figure 5-1 combines and illustrates the data from Tables 5-1 and 5-2, Management and User Cost

5.4 IMPLEMENTATION AND SUPPORT COSTS

The costs of fully implementing and supporting AFTOMS over a period of 15 years is shown in TABLE 5-3. The AFTOMS costs assumes the following:

- One Air Force Technical Order Management Agency (AFTOMA);
- Twelve Regional Centers, Technical Order Management Agency (TOMA);
- Nine MAJCOM OPRs
- 261 Base Libraries (120 major and 141 minor), Consolidated Technical Order Distribution Office (CTODO).

The cost to implement AFTOMS is expected to be $267 million over the next seven years,[51] in addition to $38.7 million per year to maintain the system hardware, software, telecommunications and facilities, and $91 million needed to convert TOs.

TABLE 5-3. FIFTEEN YEAR AFTOMS COSTS ($M)

STAGE	PLAN			DEVELOP		IMPLEMENT			TOTAL	ON-GOING SUPPORT[52]													TOTAL
YEAR	88	89	90	91	92	93	94	95	(88–95)	96	97	98	99	00	01	02	03	04	05	06	07	08	(96–08)
AFTOMS	1	6	5	13	15	52	70	105															
TO CONV			7	7	7	7	7	7		7	7	7	7	7	7	7							91
COST DRIVERS				SW and HW Personnel Telecommunications Facilities						38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	503.0
SUBTOTAL	1	6	12	20	22	59	77	112	$309	45.7	45.7	45.7	45.7	45.7	45.7	45.7	39	39	39	39	39	39	$594[53]
TOTAL COSTS INCLUDE DEVELOPMENT, INVESTMENT, O&S AND DATA CONVERSION—$903M																							

5.5 COMPARISON OF BENEFITS VERSUS COSTS

For the next seven to fifteen years the Air Force must maintain a dual system of creating, deploying and managing TOs. The current TO system cannot be immediately replaced by a new system for TOs because of the size, complexity, digitization of current TOs, and interrelated nature of the TO activities. Consequently, the cost benefits associated with the **managers** ($1.37B, as described in Section 5.1) and **users** ($2.14B, as described in Section 5.2), have been calculated incrementally based on the assumptions contained in Appendix A. These

51. Refer to Appendix A, fact ao.
52. Refer to Appendix A, assumption ap.
53. Refer to Appendix A, assumption aq.

cost benefits were then spread over the 15 year system life cycle for a total LCC savings of **$3.5B** (1.4 + 2.1). The life cycle system costs benefits were then compared against system development, implementation and operating costs of **$903M**, which resulted in a **net savings of $2.6B** (3.5 – 0.9). Cost avoidance savings were not used to compute return on investment or net savings. TABLE 5-4 illustrates the 15 year net cash flow if AFTOMS was to be implemented.

TABLE 5-4. FIFTEEN YEAR NET CASH FLOW ($B)

YEAR	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	TOTAL
INFLOWS[54]	.083	.111	.142	.172	.202	.216	.233	.247	.262	.277	.292	.306	.320	.320	.320	$3.5
OUTFLOWS[55]	.190	.112	.046	.046	.046	.046	.046	.046	.046	.039	.039	.039	.039	.039	.039	$.9
PROJECTED NET SAVINGS[56]	-.107	-.101	.096	.126	.156	.170	.187	.201	.216	.238	.254	.267	.281	.281	.281	**$2.6**

Internal Rate of Return (IRR) = 74% Payback = 7.7 years (from 1989) Project Net Savings = $2.6B

The information presented in this report demonstrates some of the costs involved with the TO system, and the increased efficiency and benefits that may be gained through automation. Because AFTOMS is an Air Force wide improvement, full implementation will take longer. However, potential overall benefits gained will be greater than lower-level automation improvements.

The benefits gained from full automation are generated by improving the interfaces between TO areas, reducing operating costs through the digitization of technical data, and increasing the productivity of the workforce. When the benefits via automation are considered individually, they may not appear significant. However, when viewed as an Air Force-wide improvement, the cost benefits, cost avoidance, and intangible benefits are substantial. The comparison of cost benefits to system cost does not consider any monetary savings realized from the intangible benefits addressed previously, since these benefits could not be accurately quantified. Additionally, all costs are considered as constant and have not been inflated in the out years. The bottom-line, is that the implementation of AFTOMS is cost effective with a Return-On-Investment (ROI) in approximately seven to eight years.

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54. Inflows = Manager Cost Benefit + User Cost Benefit; or $3.50B = $1.37B + $2.14B
55. Outflows = Total Development and Support Costs; or $658M
56. Project Net Savings = Inflows - Outflows; or $2.9B = $3.50B - $.601M

APPENDICES

FACTS AND ASSUMPTIONS

MISSION CAPABLE RATES

TECHNICAL ORDER MANAGEMENT PRODUCTIVITY STUDY

ACTIVE AND RESERVE MAINTENANCE PERSONNEL STRENGTHS

USER TECHNICAL ORDER FUNCTIONS

APPENDIX A:
FACTS AND ASSUMPTIONS

APPENDIX A

FACTS (F) AND ASSUMPTIONS (A)

a. (A) There are 23 million TO pages, and 2.3 million are changed each year.

b. (F) Routine TO changes require 210 days per AFLC regulations.

c. (A) There are 4000 technical orders added to the system each year. Thirty percent of the TOs are for new systems. (Information provided by AFLC/MMTIB GO22).

d. (F) Acquisition of new TOs from the contractors costs $1000.00 per page. Reference AF Audit #55036410, 24 June 1986.

e. (A) When implemented, AFTOMS will reduce TO acquisition costs by 25%.

f. (A) AFTOMS will permit TOs to be reviewed on-line resulting in 50% fewer in-person TO reviews.

g. (F) There are 3,000 TO management personnel (full time) equivalents assigned at MAJCOM level, the AFLC Centers, and all the AFSC product divisions. These personnel are directly involved in acquiring, changing, processing, and distributing TOs. Validated by HQ AFLC/ACC.

h. (A) The mix of personnel involved in management of TOs is 45% civilian, 45% military (all enlisted), and 10% contractors.

i. (F) Mailing costs for FY87 at all ALCs were $1.2 million. Information provided by HQ AFLC/DAP.

j. (A) LCC savings for benefits dependent upon digitization beginning in 1994 when 19.8% will be digitized and increased at a rate of 6.6% per year until maximum of 90% are digitized.

k. (A) Warehouse base will be reduced:
   1. Present warehouse space is 350,000 sq. ft.
   2. The TRCs presently use approximately 140,000 sq. ft. to store maintenance TO files.
   3. As TOs are converted, this floor space within the TRCs and warehouses can be converted to other needs.
   4. Warehouse operating costs for storing TOs is approximately 3.2M annually based on input from AFLC/DAPD dated 29 December 1987.

l. (A) Warehouse space saving will only be realized after 50% of the TOs have been digitized.

m. (A) Of the 3,000 personnel equivalents involved in TO management, 5.3% are managers, 44.5% are journeymen (technicians and/or supervisors), and 50.2% are technicians (Appendix C).

n. (F) Savings in personnel efforts resulting from automation are as follows (from the Booz-Allen studies):

   Manager: 15.02%

Journeyman: 21.51%
Technician: 32.94%

o. (F) Warehouse construction cost is $50.00 per sq. ft. (HQ AFLC/DE).

p. (A) Printing costs will gradually shift to the users as print-on-demand is implemented and will be considerably reduced as paper-less TOs become more common.

q. (F) Printing Costs:
   1. EEIC 501 funding is used for printing TOs and TO changes. HQ AFLC/DAR manages AFLC EEIC 501 funding. The FY88 AFLC EEIC 501 budget for printing TOs and printing TO changes was $6.61M. Source: HQ AFLC/DAR, Mr Blak.
   2. EEIC 501 funding is used for printing TOs and TO changes. HQ AFSL/DAR manages AFSC EEIC 501 funding. The FY88 AFSC EEIC 501 budget for printing TOs and printing TO changes was $3.5M. Source: HQ AFSC/DAR, JCP2 Report as required annually by AFR 6-1. Mr Knepper.

r. (A) Digitization of TOs and the resulting on-line change review process will result in 20% fewer repeat TO changes per year.

s. (F) EEIC 594 funding is used to contract out TO changes to prime contractors and to overflow contractors. EEIC 594 funding is not used for printing TOs and TO changes. The FY 88 EEIC 594 budget for AFLC was $22.3 million and the FY 89 budget is $27.5 million. (AFLC /DAR)

t. (F) Technical Order changes are accomplished 80% by contractor and 20% by in-house and overflow contractors. (AFLC/MMD)

u. (F) AFR 173-13 pay scales for civilian/military personnel are used for all costing information.

v. (A) All AFLC maintained TOs will be digitized within 15 years. This represents approximately 90% of the TOs. The rate of digitization will be 6.6% per year beginning in FY90. TOs from other services will be image scanned.

w. (F) The time to accomplish a TO change versus the time to initially digitize the technical order page and then accomplish the change is additive, i.e., it takes the same staff and equipment .5 hours to digitize the data and .4 hours to create a change using digitized data. The ratio of total time required is .4 (already digital source data) to .9 hours (paper source data). Stated in other terms, it takes approximately 50% longer to digitize paper data and create a TO change than to create the change from a digital database. These average factors consider graphic to text mix, complexity of change, etc.

x. (A) On-line review of TO changes will result in 20% fewer changes.

y. (A) A 50% reduction in costs associated with producing a change page will be realized when TOs are digitized.

z. (A) An all-digital TO environment will reduce the time spent by maintenance technicians in searching for and through TOs to find information needed for maintenance tasks by at least 25%.

aa. (A) AFTOMS will be implemented at the rate of 20% per year and the full yearly savings will be realized at the beginning of FY98.

ab. (A) Each AFTOMS base will have one CTODO and an average of four TODOs, or an Air Force total of 1305 CTODOs/TODOs.

ac. (F) HQ USAF/PRME uses a 60% factor to estimate the amount of time an Air Force maintenance specialist spends directly on maintenance tasks. The other 40% of the specialist's time is spent in: lag time, i.e., awaiting delivery of tools, aircraft arrival, parts delivery, etc.; commander's calls; shop upkeep; travel time to/from the flightline or worksite; administrative duties; safety meetings, etc. This factor cannot be applied in a wartime scenario. HQ AFLC/XPM concurred verbally on 24 January 1989.

ad. (A) Accrual of benefits from implementation of AFTOMS begin in 1994 for Tier 1 and Tier 2 implementation, and in 1995 for Tier 3 implementations. Accrual of benefits begin for Tier 4 when AFTOMS presentation systems are fully installed, and the change-over completed from current organizations, manual systems, etc. For the purpose of this analysis Tier 4 benefits were assumed to begin in 1994.

ae. (F) Per HQ USAF/PRME, the Air Force standard peacetime planning factor for military personnel availability is 145.1 hours per month or 1,741.2 hours per year and 145.3 hours per month/1,743.6 per year for civilians. Based upon the norm of 2,080 total hours per year, the availability ration is 83.712%. The standard wartime sustained personnel availability planning factor is 2928 hours per year.

af. (A) Thirty percent of maintenance manhours expended are devoted to researching TOs. This was derived by reviewing IMIS and ITDS data and discussions with maintenance managers.

ag. (A) A 25% improvement in productivity because of TO inefficiencies that can be realized.

ah. (A) User presentation system implemented at the rate of 6.6% per year beginning in 1994.

ai. (F) The weight of the C-5 G-File is 410 pounds, MAC/LGM.

aj. (F) The weight of the C-141 G-File is 150 pounds, MAC/LGM.

ak. (F) The weight of the C-130 G-File is 180 pounds, MAC/LGM.

al. (F) ASD/YC studies indicate that digitization of on-board C-17 TOs (1,000 lbs) will result in fuel savings of $17M across the life cycle of the fleet.

am. (F) The HQ MAC/DOV planning factor for fuel consumption per pound of cargo is 3.5% for the C-5A/B; 4.7% for the C-141B; and 5.2% for the C-130 E/H aircraft.

an. (A) The weight of the optical reader, computer and disc jukebox is 50 pounds, MAC/LGXA.

ao. (F) AFTOMS budget is $250M.

ap. (A) AFTOMS support costs were extracted from the Feasibility Study, Section 9.

aq. (A) Support cost for AFTOMS will remain constant from FY1996 to FY2008.

ar. (A) Fuel savings for MAC aircraft (C-5, C-141 and C-130) will begin in FY2000 when all aircraft are modified. C-17 savings is calculated as a one time savings.

as. (A) ALC/MM-R on-line review of changes will improve TO accuracy and reduce TO redos by 20%. Change coordination processing time will be reduced by 30%.

at. (A) Distribution costs will be reduced at the rate of 6.6% per year.

au. (F) Mailing costs will be reduced by 90% after AFTOMS is fully implemented because technical orders and related data will be distributed via digital media instead of paper.

av. (F) An average TO consists of 150 pages, 60% is text and 40% is graphics.

aw. (A) Beginning in 1994 and coinciding with AFTOMS implementation, all new TOs will be delivered and distributed in digital format, eliminating AFLC and AFSC printing costs for warehouse stocks of paper copies and printing of all changes for those new TOs.

ax. (A) The length of time taken to accomplish a change in-house or by contractor is the same.

ay. (A) Based on the historical ratio between graphics and text pages (60/40), we assumed that the average change page required .4 hours to accomplish.

az. (F) In-house change page processing and production manhours for previously digitized pages, range from 5 minutes to 1 hour and ten minutes depending upon the amount of graphics, tables, and the complexity and number of changes per page.

ba. (A) It is assumed that a 50% reduction in costs can be achieved after AFTOMS is implemented and the TOs are digitized.

bb. (A) The following are assumed in determining the total annual costs savings to produce change pages:

1. TO changes do not require the basic TO page itself to be digitized prior to effecting the change;
2. On-line review can be accomplished;
3. It does not require a repro-master to be produced, etc.

bc. (F) Sixty percent of Air Force maintenance personnel are involved in direct-labor activities and 40% of the total workforce are employed in indirect-labor activities such as management, supervision, MAJCOM staffs, Inspector General teams, ATC instructors, etc. This factor was developed with the assistance of HQ USAF/PRME.

bd. (A) Digitization of GO22 management reports will eliminate printing and provide more timely management information.

be. (A) Acquisition costs for new TOs will be reduced by 25% or $250.00 per page.

bf. (F) Based on current estimates from the ALCs they can produce 1000 to 1500 pages per month per ALC. The resulting yearly output 72,000 to 108,000 pages. This information is based upon current manning levels and incorporation of the current system ECPs.

bg. (A) Microfiche TO indices will be eliminated by AFTOMS.

bh. (A) AFTOMS efficiencies will allow personnel presently involved with managing, administering and using TOs to be redirected to other primary duties.

bi. (F) There are presently 3154 standard TODOs identified throughout the Air Force. The GO22 system identifies 7308 accounts of which 697 are contractors, 1598 are JMEMs accounts, 739 are fire departments, 899 are other military services and accounts, and 321 are FMS. Information provided by OC ALC/MMEDU.

bj. (F) Funding was established early in the program for 150 Consolidated Technical Order Distribution Offices (CTODOs), based upon 1986 dollars. The actual number of CTODOs will be dependent upon cost of the equipment and future budget submissions and actions.

bk. (F) The employment concept for AFTOMS indicates there will be a single CTODO at all 261 major and minor Air Force bases. An average of four additional TODOs will be needed at bases with large units to manage their subaccounts. Current funding limits will allow only 150 TODOs.

bl. (F) The total number of personnel in maintenance AFSCs within the Active Air Force is 214,429 active duty military and civilian, and 58,000 reserve personnel. Of that number 20.4% are civilian. The Reserve Forces strength is 57,764 personnel. The above numbers do not include operators, aircrew members, and other enlisted and officer personnel that were considered to be occasional users. See Appendix D.

bm. (A) The average cost of a new aircraft is $50M with a life cycle of 20 years.

bn. (F) The average maintenance manhours per flying hour for fighter aircraft is 23.12 mhrs/fhr based on the information provided by the AFLC/LOC.

bo. (F) The average maintenance manhour per flying hour for bomber aircraft is 52.1 mhr/fhr based on information provided by AFLC/LOC

bp. (F) The average maintenance manhours per flying hours for cargo aircraft is 26.48 mhr/fhr based on information provided by AFLC/LOC

bq. (A) The G-File for MAC cargo aircraft will be digitized.

br. (F) The cost to manually change a TO page was established in the ATOS Pilot Program Economic Analysis as $580.20 per page.

bs. (F) 75.34% of the 148,081 TOs identified in the Logistics Management of Technical Orders System (LMTOS, DSD G022) are "books", i.e., each TO averages 150 pages. The normal range of TO sizes is from 100 to 1,000 pages. The remaining 24.64% are smaller, i.e, they range in size from 4 pages to less than 100 pages.

bt. (A) The Air Force will not digitize TOs for contractor maintained systems.

bu. (A) A LAN will be available at each installation site to connect MAJCOM provided user systems to the CTODO. LANs are already installed at each ALC .

bv. (A) DDN will be available for AFTOMS long-haul communications.

bw. (A) Technical order standards and specifications will be developed for all technical manuals.

bx. (A) Trained personnel will be available for each AFTOMs implementation.

by. (F) The AFTOMA will be the centralized manager of AFTOMS.

bz. (A) Current manpower levels will remain constant as of September 1988.

ca. (A) Classified TOs will be not be distributed within AFTOMS.

cb. (F) AFTOMS will manage TYPE A, B, B(-), B(+), and C technical orders.

cc. (F) The in-house cost to scan a TO page (create an ATOS digital file) was established at an ATOS/AFTOMS meeting at OC-ALC/MMED, OO-ALC/MMED, and SA-ALC/MMED in late FY88 as an average of (.5) manhours of combined staff time at a cost of $17.82 per hour.

cd. (F) The contractor cost to scan a TO page is as follows:

1. Contractor, (DUCUCON INC.) rate is established at $3.70 per page to create a ASCII file with SGML tags. and graphics in raster images.
2. Contractor (STS INC) quoted $4.00 per page fro more complete scanning to include quality assurance. This quote is based on a minimum of 500,000 pages.
3. Northeast Scanning quoted $1.80 per page to scan TOs, ASCII file with SGML tags and raster images.

ce. (F) Three million transactions are processed by TO warehouses each year (ATOS Phase II EA).

cf. (F) Mission Capable Rates for selected aircraft are as follows (percentages, extracted from the G033B report, 10/31/88):

B-52G	78.2	B-52H	80.7
B-1	33.7	C-5A	59.5
C-5B	73.8	C-130E	74.5
C-130H	75.4	C-141	70.4
KC-135A	89.4	KC-135E	78.0
KC-135	89.7	F-4E	77.9
F-4G	77.8	RF-4C	77.4
F-15A	80.7	F-15B	82.3
F-15C	82.9	F-15D	82.9
F-16A	83.5	F-16B	85.9
F-16C	90.4	F-16D	92.0
F-111A	80.0	F-111D	70.8
F-111E	72.3	F-111F	73.9
A-10	83.3		

cg. (F) Selected Aircraft Flying Hours Rates provided by HQ AFLC/MM:

B-52G	68,488	F-15A	73,491
B-52H	35,933	F-15B	14,420
B-1	12,188	F-15C	100,128
C-5A	47,330	F-15D	16,568
C-5B	12,122	F-16A	176,568
C-130E	161,867	F-16B	33,097
C-130H	70,124	F-16C	91,847
C-141B	282,651	F-16D	11,744
KC-135A	109,051	F-111A	11,000
KC-135E	49,866	F-111D	20,423
KC-135R	27,240	F-111E	19,901
F-4E	94,088	F-111F	22,944

F–4G	23,856	A–10	222,181
RF–4C	73,158		

APPENDIX B:
MISSION CAPABLE RATES

APPENDIX B

MISSION CAPABLE RATES/AIRCRAFT AVAILABILITY IMPROVEMENTS

AIRCRAFT TYPE MAX %	MC RATE INCR	MC RATE INCR 50%	* MC RATE INCR 25%	AIRCRAFT AVAIL 50%	* AIRCRAFT AVAIL 25%
B-52G	5.8	2.9	1.45	4.8	2.4
B-52H	6.0	3.0	1.5	2.8	1.4
B-1	2.5	1.25	.62	1.2	.6
KC-135A	6.6	3.3	1.65	9.6	4.8
KC-135E	5.8	2.9	1.45	4.0	2.0
KC-135R	6.7	3.35	1.67	4.0	2.0
C-130E	5.6	2.8	1.4	7.4	3.7
C-130H	5.6	2.8	1.4	4.0	2.0
C-141	5.9	3.0	1.5	7.4	3.7
C-5A	4.4	2.2	1.1	1.6	.8
C-5B	5.5	2.8	1.4	1.2	.6
F-4E	5.8	2.9	1.5	11.4	5.7
F-4G	5.8	2.9	1.5	2.8	1.4
RF-4C	5.7	2.8	1.4	8.6	4.3
F-15A	6.7	3.4	1.7	8.6	4.3
F-15B	6.1	3.0	1.5	1.6	.8
F-15C	6.2	3.05	1.5	12.0	6.0
F-15D	6.2	3.05	1.5	1.6	.8
F-16A	6.2	3.05	1.5	17.2	8.6
F-16B	6.4	3.2	1.6	3.4	1.7
F-16C	6.7	3.4	1.7	17.2	8.6
F-16D	6.8	3.4	1.7	2.2	1.1
F-111A	6.2	3.1	1.6	1.2	.6
F-111D	5.2	2.6	1.3	1.8	.9
F-111E	5.4	2.8	1.4	2.4	1.2
F-111F	5.5	2.8	1.4	2.4	1.2
A-10	6.2	3.1	1.55	20.0	10.0
****TOTAL**	**5.5**	**3.0**	**1.5**	**162.4**	**81.2**

Average Cost Of Aircraft $50M(annualized cost $2.5M for 20 years)

COST AVOIDANCE

	AIRCRAFT	COST	COST PER YEAR
25%	81	$4.05B	$202.5M
50%	162	$8.1B	$405.0M

* Achievable level of savings

**Approximate average

COMPUTATIONS FOR SELECTED AIRCRAFT MISSION CAPABLE RATES

Computations (In Millions)

A/C Type	MM Hrs E	MC Hrs	A/C Av Hrs %	MC Hrs N	MC Rate	MC Hrs I
B-52G	4.195	1.135	1.454	1.220	5.8	.085
B-52H	1.347	.672	.832	.722	6.0	.05
B-1	.526	.282	.841	.303	2.5	.021
KC-135A	3.359	2.316	2.593	2.489	6.6	.17
KC-135E	1.107	.957	1.226	1.029	5.8	.07
KC-135R	.594	1.053	1.174	1.131	6.7	.07
C-130E	3.691	1.801	2.418	1.936	5.6	.13
C-130H	1.096	.964	1.279	1.036	5.6	.07
C-141	7.321	1.857	2.339	1.996	5.9	.13
C-5A	3.119	.401	.674	.431	4.4	.03
C-5B	.364	.303	.412	.325	5.5	.02
F-4E	3.791	2.692	3.460	2.893	5.8	.2
F-4G	.963	.694	.894	.746	5.8	.05
RF-4C	2.480	1.953	2.523	2.099	5.7	.15
F-15A	2.468	1.830	2.270	1.984	6.7	.15
F-15B	.262	.375	.456	.403	6.1	.03
F-15C	2.453	2.803	3.381	3.013	6.2	.21
F-15D	.306	.436	.526	.468	6.2	.03
F-16A	3.265	4.374	5.238	4.702	6.2	.3
F-16B	.273	.820	.955	.881	6.4	.06
F-16C	1.148	4.342	4.809	4.667	6.7	.3
F-16D	.109	.596	.648	.641	6.8	.04
F-111A	.570	.301	.376	.323	6.2	.02
F-111D	.718	.489	.692	.526	5.2	.03
F-111E	.722	.506	.700	.543	5.4	.03
F-111F	.315	.550	.745	.591	5.5	.04
A-10	3.18	4.736	5.685	5.091	6.2	.35

APPENDIX C: TECHNICAL ORDER MANAGEMENT PRODUCTIVITY STUDY

APPENDIX C
TECHNICAL ORDER MANAGEMENT PRODUCTIVITY STUDY

3.1 PERSONNEL COST DEVELOPMENT

3.1.1 Staff Level Cost Development

	Annual Labor Cost by Level*		
Labor Category / (% of T.O. Effort)	**Senior-Level Base / Weighted**	**Mid-level Base / Weighted**	**Lower-level Base / Weighted**
Military / (45%)	$54,038 / $24,317	$37,954 / $17,079	$24,230 / $10,904
Civilian / (45%)	$63,473 / $28,563	$29,223 / $13,150	$18,103 / $8,146
Contractor / (10%)	$150,000 / $15,000	$87,500 / $8,750	$50,000 / $5,000
Total Annual Cost Weighted by % of Military, Civilian, and Contract Personnel	$67,880	$38,979	$24,050
% of Participation in TO Effort (Section D.1.2)	X5.3%	X 44.5%	X 50.2%
Annual Cost Component by Level	$3,598	$17,345	$12,074
Senior Component	$3,598		
Mid-level Component	$17,345		
Lower-level Component	$12,074		
Avg. Weighted Composite Staff Year Cost	**$33,017**		

3.1.2 Staff Composition Profile

Function / (Weight %)	Staff Level Percentage					
	Senior-Level		Mid-level		Lower-level	
	Base	/ Weighted	Base	/ Weighted	Base	/ Weighted
Change Processing (30%)	10	3	40	12	50	15
Review (25%)	2	0.5	45	11.25	53	13.25
Development (15%)	2	0.3	55	8.25	43	6.45
Distribution (10%)	5	0.5	20	2	75	7.5
Printing (10%)	5	0.5	20	2	75	7.5
Planning (10%)	5	0.5	90	9	5	0.5
% of Staff Level Participation Weighted by Function		5.3%		44.5%		50.2%

3.2 TIME SAVINGS CALCULATIONS

3.2.1 Potential Time Savings Worksheet (Senior–level)

Activities	Composite Percent of Time Spent	Potential Time Savings	Percent of Total Time Saved
Document Creation			
Writing/Revising/Proofing	5.75	20%	1.15
Typing	0.00	40%	0.00
A. TOTAL			1.15
Administration			
Seeking Information	6.25	50%	3.13
Seeking People	1.25	25%	0.31
Scheduling *	0.50	0%	0.00
Filing/Copying	1.25	50%	0.63
Waiting for Work	1.25	20%	0.25
Traveling/Other	4.50	10%	0.45
B. TOTAL			4.77
Communications			
Face–to–Face	42.25	5%	2.11
Telephone	8.25	20%	1.65
Reading	8.50	10%	0.85
C. TOTAL			4.61
Analysis			
Evaluating/Calculating	8.75	25%	2.19
Planning	11.50	20%	2.30
D. TOTAL			4.49
E. TOTAL POTENTIAL TIME SAVINGS			**15.02**

3.2.2 Senior-level Composite

Activities	Function (% of Total Tech Order Effort) * Change Processing (30%)	Review (25%)	Development (15%)	Distribution (10%)	Printing (10%)	Planning (10%)	Senior-Level Composite Total (100%)
Document Creation							
Writing/Revising/ Proofing	2.1	1.75	0.3	0.7	0.7	0.2	5.75
Typing	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Administration							
Seeking Information	1.5	1.25	1.5	0.5	0.5	1.0	6.25
Seeking People	0.3	0.25	0.3	0.1	0.1	0.2	1.25
Scheduling	0.0	0.0	0.3	0.0	0.0	0.2	0.50
Filing/Copying	0.3	0.25	0.3	0.1	0.1	0.2	1.25
Waiting for Work	0.3	0.25	0.3	0.1	0.1	0.2	1.25
Traveling/Other	1.2	1.0	0.9	0.4	0.4	0.6	4.50
Communications							
Face-to-Face	12.9	10.75	6.0	4.3	4.3	4.0	42.25
Telephone	2.4	2.0	1.35	0.8	0.8	0.9	8.25
Reading	2.7	2.25	1.05	0.9	0.9	0.7	8.50
Analysis							
Evaluating/Calculating	2.7	2.25	1.2	0.9	0.9	0.8	8.75
Planning	3.6	3.0	1.5	1.2	1.2	1.0	11.50
TOTAL	30%	25%	15%	10%	10%	10%	100%

* % of Time Spent on Each Activity (Sections D.3.1 – D.3.6) multiplied by the weighting factor (% of Total Tech Order Effort) for each function.

3.2.3 Potential Time Savings Worksheet (Middle-level)

Activities	Composite Percent of Time Spent	Potential Time Savings	Percent of Total Time Saved
Document Creation			
Writing/Revising/Proofing	13.25	20%	2.65
Typing	0.00	40%	0.00
A. TOTAL			2.65
Administration			
Seeking Information	13.50	50%	6.75
Seeking People	1.25	25%	0.31
Scheduling *	0.50	0%	0.00
Filing/Copying	6.25	50%	3.13
Waiting for Work	1.25	20%	0.25
Traveling/Other	6.00	10%	0.60
B. TOTAL			11.04
Communications			
Face-to-Face	23.00	5%	1.15
Telephone	7.25	20%	1.45
Reading	7.75	10%	0.78
C. TOTAL			3.38
Analysis			
Evaluating/Calculating	8.75	25%	2.19
Planning	11.25	20%	2.25
D. TOTAL			4.44
E. TOTAL POTENTIAL TIME SAVINGS			**21.51**

3.2.4 Mid-level Composite

Activities	Function (% of Total Tech Order Effort) * Change Processing (30%)	Review (25%)	Development (15%)	Distribution (10%)	Printing (10%)	Planning (10%)	Mid-Level Composite Total (100%)
Document Creation							
Writing/Revising/ Proofing	5.1	4.25	0.3	1.7	1.7	0.2	5.75
Typing	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Administration							
Seeking Information	4.5	3.75	1.35	1.5	1.5	0.9	13.5
Seeking People	0.3	0.25	0.3	0.1	0.1	0.2	1.25
Scheduling	0.0	0.0	0.3	0.0	0.0	0.2	0.5
Filing/Copying	1.5	1.25	1.5	0.5	0.5	1.0	6.25
Waiting for Work	0.3	0.25	0.3	0.1	0.1	0.2	1.25
Traveling/Other	1.8	1.50	0.9	0.6	0.6	0.6	6.0
Communications							
Face-to-Face	6.0	5.0	4.8	2.0	2.0	3.2	23.0
Telephone	2.1	1.75	1.2	0.7	0.7	0.8	7.25
Reading	2.4	2.0	1.05	0.8	0.8	0.7	7.75
Analysis							
Evaluating/Calculating	3.0	2.5	0.75	1.0	1.0	0.5	8.75
Planning	3.0	2.5	2.25	1.0	1.0	1.5	11.25
TOTAL	30%	25%	15%	10%	10%	10%	100%

* % of Time Spent on Each Activity (Sections D.3.1 - D.3.6) multiplied by the weighting factor (% of Total Tech Order Effort) for each function.

3.2.5 Potential Time Savings Worksheet (Lower–level)

Activities	Composite Percent of Time Spent	Potential Time Savings	Percent of Total Time Saved
Document Creation			
Writing/Revising/Proofing	35.75	20%	13.15
Typing	0.00	40%	0.00
A. TOTAL			13.15
Administration			
Seeking Information	8.75	50%	4.38
Seeking People	3.20	25%	0.80
Scheduling *	0.85	0%	0.00
Filing/Copying	19.75	50%	9.88
Waiting for Work	5.00	20%	1.00
Traveling/Other	6.15	10%	0.62
B. TOTAL			16.67
Communications			
Face–to–Face	4.55	5%	0.23
Telephone	6.05	20%	1.21
Reading	4.55	10%	0.46
C. TOTAL			1.89
Analysis			
Evaluating/Calculating	3.00	25%	0.75
Planning	2.40	20%	0.48
D. TOTAL			1.23
E. TOTAL POTENTIAL TIME SAVINGS			**32.94**

3.2.6 Lower-level Composite

Activities	Function (% of Total Tech Order Effort) * Change Processing (30%)	Review (25%)	Development (15%)	Distribution (10%)	Printing (10%)	Planning (10%)	Lower-level Composite Total (100%)
Document Creation							
Writing/Revising/ Proofing	12.0	12.5	0.75	5.0	5.0	0.5	35.75
Typing	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Administration							
Seeking Information	3.0	2.5	0.75	1.0	1.0	0.5	8.75
Seeking People	1.5	0.25	0.75	0.1	0.1	0.5	3.2
Scheduling	0.6	0.0	0.15	0.0	0.0	0.1	0.85
Filing/Copying	1.5	2.5	8.25	1.0	1.0	5.5	19.75
Waiting for Work	1.5	1.25	0.75	0.5	0.5	0.5	5.0
Traveling/Other	1.5	1.75	0.9	0.7	0.7	0.6	6.15
Communications							
Face-to-Face	1.5	1.0	0.75	0.4	0.4	0.5	4.55
Telephone	3.0	1.0	0.75	0.4	0.4	0.5	6.05
Reading	1.5	1.0	0.75	0.4	0.4	0.5	4.55
Analysis							
Evaluating/Calculating	0.9	0.75	0.45	0.3	0.3	0.3	3.0
Planning	1.5	0.5	0.0	0.2	0.2	0.0	2.4
TOTAL	30%	25%	15%	10%	10%	10%	100%

* % of Time Spent on Each Activity (Sections D.3.1 - D.3.6) multiplied by the weighting factor (% of Total Tech Order Effort) for each function.

3.3 ACTIVITY PROFILES

3.3.1 Change Processing

Activities	Percent of Time Spent on Each Activity		
	Senior	Mid-level	Lower-level
Document Creation			
Writing/Revising/Proofing	7	17	40
Typing	--	--	--
Administration			
Seeking Information	5	15	10
Seeking People	1	1	5
Scheduling	--	--	2
Filing/Copying	1	5	5
Waiting for Work	1	1	5
Traveling/Other	4	6	5
Communications			
Face-to-Face	43	20	5
Telephone	8	7	10
Reading	9	8	5
Analysis			
Evaluating/Calculating	9	10	3
Planning	12	10	5
TOTAL	100%	100%	100%

3.3.2 The Review Function

Activities	Percent of Time Spent on Each Activity		
	Senior	Mid-level	Lower-level
Document Creation			
Writing/Revising/Proofing	7	17	50
Typing	--	--	--
Administration			
Seeking Information	5	15	10
Seeking People	1	1	1
Scheduling	--	--	--
Filing/Copying	1	5	10
Waiting for Work	1	1	5
Traveling/Other	4	6	7
Communications			
Face-to-Face	43	20	4
Telephone	8	7	4
Reading	9	8	4
Analysis			
Evaluating/Calculating	9	10	3
Planning	12	10	2
TOTAL	100%	100%	100%

3.3.3 Development

Activities	Percent of Time Spent on Each Activity		
	Senior	Mid-level	Lower-level
Document Creation			
Writing/Revising/Proofing	2	2	5
Typing	--	--	--
Administration			
Seeking Information	10	9	5
Seeking People	2	2	5
Scheduling	2	2	1
Filing/Copying	2	10	55
Waiting for Work	2	2	5
Traveling/Other	6	6	6
Communications			
Face-to-Face	40	32	5
Telephone	9	8	5
Reading	7	7	5
Analysis			
Evaluating/Calculating	8	5	3
Planning	10	15	--
TOTAL	100%	100%	100%

3.3.4 Distribution

Activities	Percent of Time Spent on Each Activity		
	Senior	Mid-level	Lower-level
Document Creation			
Writing/Revising/Proofing	7	17	50
Typing	--	--	--
Administration			
Seeking Information	5	15	10
Seeking People	1	1	1
Scheduling	--	--	--
Filing/Copying	1	5	10
Waiting for Work	1	1	5
Traveling/Other	4	6	7
Communications			
Face-to-Face	43	20	4
Telephone	8	7	4
Reading	9	8	4
Analysis			
Evaluating/Calculating	9	10	3
Planning	12	10	2
TOTAL	100%	100%	100%

3.3.5 Printing

Activities	Percent of Time Spent on Each Activity		
	Senior	Mid-level	Lower-level
Document Creation			
Writing/Revising/Proofing	7	17	50
Typing	--	--	--
Administration			
Seeking Information	5	15	10
Seeking People	1	1	1
Scheduling	--	--	--
Filing/Copying	1	5	10
Waiting for Work	1	1	5
Traveling/Other	4	6	7
Communications			
Face-to-Face	43	20	4
Telephone	8	7	4
Reading	9	8	4
Analysis			
Evaluating/Calculating	9	10	3
Planning	12	10	2
TOTAL	100%	100%	100%

3.3.6 Planning

Activities	Percent of Time Spent on Each Activity		
	Senior	Mid-level	Lower-level
Document Creation			
Writing/Revising/Proofing	2	2	5
Typing	--	--	--
Administration			
Seeking Information	10	9	5
Seeking People	2	2	5
Scheduling	2	2	1
Filing/Copying	2	10	55
Waiting for Work	2	2	5
Traveling/Other	6	6	6
Communications			
Face-to-Face	40	32	5
Telephone	9	8	5
Reading	7	7	5
Analysis			
Evaluating/Calculating	8	5	3
Planning	10	15	--
TOTAL	100%	100%	100%

3.4 ADMINISTRATIVE ACTIVITIES AND POTENTIAL IMPROVEMENTS

Documentation Creation	Definition	Applicable Tools	How Time Is Saved	% Savings*	Additional Benefits
Writing/ Revising/ Proofing	Composition of text, editing and revision, proofreading for accuracy and corrections	*Text Processing*	Documents can be assembled from stored text (e.g., "boiler plate" or address list merge) Text can be rearranged easily Only changed areas are rekeyed, and need to be proofed	20%	Improved quality/ appearance of final documents Same text editor may be used for electronic communication
Typing	Keyboard entry of text	*Text Processing*	Principal savings occur in revision typing Only changed material is retyped Global changes can be made Spelling errors can be detected by the machine automatically	40%	Improved accuracy of text materials with other obligations
Administration	**Definition**	**Applicable Tools**	**How Time Is Saved**	**% Savings***	**Additional Benefits**
Seeking Information	Searching for data or documents internally or from external sources	*Electronic filing* *Decision Support*	Information can be retrieved from automated systems of records much more rapidly than from manual files. Use of indexes, key word searches, etc., can help in narrowing the search	50%	More complete information can be retrieved
Seeking People	Trying to locate individuals to obtain or impart information	*Electronic Communication*	Reliable electronic communications may supplant the need to locate the individual	25%	Electronic mail provides a permanent record and permits multiple people to be addressed at once
Scheduling	Assigning timetables for meetings or other events	*Electronic Calendar*	Reduce effort in finding mutually acceptable times for meeting involving multiple participants	30%	Meetings are not scheduled arbitrarily that conflict with other obligations
Filing/Copying	Entering data and/or printed material into a system of records; duplicating printed material	*Electronic Filing* *Text Processing (with high speed printer)*	Data are entered more rapidly into an automated filing system Duplicates can be produced more rapidly and in a single operation with a high speed printer	50%	When automated filing systems are used, duplicate storage is eliminated, data are not lost, and subsequent retrieval is facilitated
Waiting for Work	Non-productive time spent waiting for new assignments or for data needed to continue working	*Electronic Communication* *Personal Computing* *Electronic Filing*	Needed information can be obtained more quickly. Individuals can control more of their own processing needs rather than relying on others.	20%	Reduction in idle time is a pure benefit, releasing non-productive activities, including those that may not currently be done

* Booz, Allen & Hamilton estimates of actual savings based on case studies.

3.4 Administrative Activities and Potential Improvements (cont'd)

Administration	Definition	Applicable Tools	How Time Is Saved	% Savings*	Additional Benefits
Traveling	Going from one location to another, internally or externally	Electronic Communication	Effective messaging system may supplant the need to travel to meetings.	10%	Reduced expenses for TDY travel
		Electronic Filing	Electronic filing system may reduce the need to travel to seek information		
Communication	**Definition**	**Applicable Tools**	**How Time Is Saved**	**% Savings***	**Additional Benefits**
Face-to-Face Meetings	Face-to-face discussions and/or presentations including two or more people	Electronic Communications	Effective messaging system may supplant the need for some meetings.	5%	
		Graphics	Graphics permit information to be presented more clearly, thus reducing the time spent in a meeting		
Telephone	Audio communications between individuals over the telephone	Electronic Communications	Avoid uncompleted telephone calls and " telephone tag."	20%	Electronic communications provides a permanent record
			Reduce overhead time in telephone conversations.		
			Send multiple copies to distribution list in a single operation		
Reading	Obtaining information from written material	Information Retrieval (with screening)	Reduce the need to read irrelevant information by retrieving only needed information	10%	
		Decision Support			
Analysis	**Definition**	**Applicable Tools**	**How Time Is Saved**	**% Savings***	**Additional Benefits**
Evaluating/ Calculating	Manipulating Data	Personal Computing	Increased speed of numerical calculations, including models	25%	More sophisticated and detailed computations are possible
Planning	Tracking and controlling the work of others	Decision Support	Permit exception reporting to substitute for complete review of events	20%	

* Booz, Allen & Hamilton estimates of actual savings based on case studies.

3.5 UNITED STATES WORKFORCE ACTIVITY PROFILES

Activities	Percent of Time Spent on Each Activity		
	Senior	Mid-level	Lower-level
Document Creation			
Writing/Revising/Proofing	10	15	5
Typing	--	--	25
Administration			
Seeking Information	6	9	10
Seeking People	2	2	5
Scheduling	2	4	2
Filing/Copying	1	2	10
Waiting for Work	1	1	10
Traveling/Other	4	4	10
Communications			
Face-to-Face	49	32	5
Telephone	9	8	10
Reading	7	7	5
Analysis			
Evaluating/Calculating	5	11	3
Planning	4	5	--
TOTAL	100%	100%	100%

Source: Booz, Allen & Hamilton
Weighted average based on U.S. workforce statistics.

APPENDIX D: ACTIVE AND RESERVE MAINTENANCE PERSONNEL STRENGTHS

APPENDIX D

ACTIVE MAINTENANCE PERSONNEL*

AFSC	CAREER FIELD	AUTHORIZED Enlisted/Civilian
30XXX	Communications-Electronics	20,822/2,256
31XXX	Missile Electronics	559/625
32XXX	Avionics Systems	12,660/6,546
34XXX	Training Devices	700/170
36XXX	Wire Communications Systems	3,879/674
41XXX	Missile Systems	4,571/760
42XXX	Aircraft Systems	28,553/17,204
43XXX	Aircraft Maintenance	40,637/7,136
45XXX	Manned Aerospace Maint	28,194/4,579
46XXX	Munitions & Weapons Maint	24,602/857
47XXX	Vehicle Maint	5,445/3,000
TOTAL		170,622/43,807
	214,429	

RESERVE MAINTENANCE PERSONNEL*

AFSC	CAREER FIELD	AUTHORIZED
32XXX	Avionic Systems	6,435
42XXX	Aircraft Systems	13,690
43XXX	Aircraft Maintenance	17,386
45XXX	Manned Aerospace Main	9,630
46XXX	Munition & Weapons Maint	7,609
47XXX	Vehicle Maint.	3,014
TOTAL		57,764 or 58,000

**Does not include officer specialties or those enlisted/civilian specialities that do not use TOs frequently*

APPENDIX E:
USER TECHNICAL ORDER FUNCTIONS

APPENDIX E

USER TECHNICAL ORDER FUNCTIONS

A—DEPARTMENT OF DEFENSE

Defense Logistics Agency Staff

Application: Spares and Bit and Piece Requisition

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Requisition, and Budgeting

OSD Staff

Application: Logistics Policy, R&D Policy, and Computer–aided Acquisition and Logistics Support

Administration:.Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

Interservice (Navy, Army, Coast Guard, and Marines) Staffs and Units

Application: Spares and Equipment Requisition, Equipment Operation, Operations and Logistics Planning, Sustaining Engineering, Structural Assessments, Modification Planning, Work Flow/Schedule Planning, Spares Improvement, Product Inspection, Completed Work Inspection, Manufacturing Parts, Maintenance (Inspection, Repair, Overhaul, Modification, Fault Isolation, Servicing, Etc.), Training, Safety, Quality Assurance, Procurement, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

B—DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration Staff

Application: Equipment Operation and Certification, Standardization, and Inspection

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

C—DEPARTMENT OF ENERGY

Nuclear Energy Staff

Application: Weapon Operation/Maintenance, Waste Disposal, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Policy, Review, and Requisition.

D—NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Space Center Staff

Application: Equipment Operation, Operational/Logistics Planning, Repair, Inspection, Servicing, Fault Isolation, Spares Requisition, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Review, and Requisition

E—HQ UNITED STATES AIR FORCE

Operations (1)

Application: Operational Planning, Equipment Operation, Standardization, Aircraft Loading Data, Contingency Planning, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

Management: Technical Order Policy, Budgeting, Approve System SON, Etc.

Maintenance (2)

Application: Logistics Planning, Equipment Operation, Standardization, Modification Planning, Maintenance Planning, Reliability–Maintainability, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

Management: Technical Order Policy, Budgeting, Approve Maintenance Concept, Creation, Etc.

Research and Development

Application: New or Modified Systems.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

Management: Develop Technical Order Policy, Budgeting, Approve System SON/SORD,. Guide TO Creation, Etc.

Reliability and Maintainability

Application: Product Improvement Evaluations, System and Component Evaluations. Aircraft Modification Evaluations, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

Supply

Application: Equipment Operation, Inspection and Servicing, Spares and Equipment Requisition, Stock Number/Part Number Indexing, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

Procurement

Application: Preparation of Procurement Requirements.

Training

Application: Review Air Force Course Development.

F—INSPECTION AND SAFETY CENTER

Inspection

Application: Management/Operation Readiness Planning, Equipment Operation, Evaluation of Inspection Findings/Replies.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

Safety

Application: Evaluation of Ground and Air Mishaps, Review of Replies to Mishap Reports, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Review, and Requisition

G—MAJOR AIR COMMANDS

Operations (1)

Application: Operational and Contingency Planning, Equipment Operation, Review and Assess Capabilities and Needs, Develop Operator Standardization, Develop Operator Equipment Techniques, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Management: Prepare SONs and SORDs for New Systems, Define and Coordinate TO Requirements, Budget, Etc.

Maintenance (2)

Application: Perform Logistics/Contingency Planning, Develop Maintenance Concept/Plan, Develop Training Requirements, Develop/Evaluate System Modifications, Analyze Component Reliability/Maintainability Shortfalls and Recommend Solutions, Standardize Equipment Maintenance/Operation, Develop Quality Assurance and Safety Programs, Prepare Budget Recommendations, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Management: Prepare Logistics/Maintenance Portion of SONs and SORDs for New Systems, Define and Coordinate TO Requirements, Prepare POM Budget, Etc.

Reliability and Maintainability

Application: Product Improvement Evaluations, System and Component Evaluations. Aircraft Modification Evaluations, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, and Requisition

Management: Prepare R&M Requirements for SONs and SORDs.

Plans and Programs

Application: Evaluate System Capabilities for New Missions or Needs, Review Present Systems, and Plan Operational/Mission Environments, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews,and Requisition

Management: Develop Technical Order Prepare POM Budget, Prepare System SON/SORD, Guide TO Creation, Etc.

Supply (2)

Application: Supply Management, Spares and Equipment Requisition, Develop Peace/Wartime Spare Requirements, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Management: Prepare Logistics/Supply Portion of the SONs and SORDs for New Systems, Define and Coordinate TO Requirements, Budget, Etc.

Procurement

Application: Prepare Procurement Requirements, Etc.

Training (1 and 2)

Application: Develop Courses (ATC or In-house MAJCOMs), Coordinated Training Requirements with ATC, Etc

Management: Prepare Logistics/Training Portion of the SONs and SORDs for New Systems, Define and Coordinate TO Requirements, Budget, Etc.

Safety

Application: Evaluation of Ground and Air Mishaps, Review of Replies to Mishap Reports, Etc

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Review, and Requisition

H--AIR FORCE LOGISTICS COMMAND

Director Material Management Technical Data

Management: Develop TO Policy, Budgets, Standardization and Identification of Requirements, Establish TOMA, Develop PMRT TO Plan, Etc.

Director of Maintenance

Management: Develop Depot Maintenance Policy, Equipment Facility, TO Requirements, Etc.

Safety

Application: Evaluation of Ground and Air Mishaps, Review of Replies to Mishap Reports, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Review, and Requisition

I--AIR LOGISTICS CENTERS

Material Management (4 and 5)

Application: Logistics Peace and Contingency Planning, Perform Weapon System Master Planning, Conduct Component and System Improvement Evaluations, Performing Structural Assessments, Spares and Equipment Requirements Determination and Requisition, Software Engineering, Develop Depot and Base System Maintenance Programs, Review and Approve/Disapprove TO Changes, etc.

Administration: Technical Order Change Processing, Filing, Registration, Distribution, In–Process Reviews, Pre Publication Reviews, and Requisition

Management: Prepare Depot Portion of the SONs and SORDs for New Systems, Define and Coordinate TO Requirements, Operate and Manage the GO 22 Technical Order System, Budget, Operate the TOMA, Etc.

Maintenance (2)

Application: Perform Logistics/Contingency Planning, Develop Maintenance Concept/Plan, Develop Training Requirements, Develop/Evaluate System Modifications, Analyze Component Reliability/Maintainability Shortfalls and Recommend Solutions, Standardize Equipment Maintenance/Operation, Develop Quality Assurance Programs, Prepare Budget Recommendations, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In–Process Reviews, Pre Publication Reviews, and Requisition

Management: Prepare Depot Maintenance Portion of the SONs and SORDs for New Systems, Define and Coordinate TO Requirements, Budget, Etc.

International Logistics

Application: Perform Logistics Planning, Review Spares and Equipment Determination and Requisition Requirements, Review/Develop Depot and Base System Maintenance Programs, Review TO Changes for Foreign Military Sales/Assistance Cases.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In–Process Reviews, Pre Publication Reviews, and Requisition for Foreign Countries.

Management: Prepare Depot Maintenance Portion of the SONs and SORDs for New Systems, Define and Coordinate TO Requirements, Budget for FMS Systems.

Quality Assurance

Application: Product and Repaired System/Component Inspection.

Administration: Technical Order Change Submittal, Registration, Filing, Distribution, In–Process Reviews, Pre Publication Reviews, and Requisition

Safety

Application: Evaluation of Ground and Air Mishaps, Review of Replies to Mishap Reports, Establishing Programs, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Review, and Requisition

Procurement and Competition Advocate

Application: Review Bid Sets, Review RFPs for Technical Consistency, Etc.

Training

Application: Develop Courses, Coordinated with ATC for Training Needs, Etc

Management: Prepare Logistics/Training Depot Portion of the SONs and SORDs for New Systems, Budget, Etc.

Distribution

Application: Develop Shipping Instructions, Monitor Component Shelf Lifes,

Administration: Technical Order Change Submittal, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Civil Engineering

Application: Perform Logistics/Contingency Planning, Develop Maintenance Concept/Plan, Develop Training Requirements, Develop/Evaluate System Modifications, Analyze Equipment Reliability/Maintainability Shortfalls and Recommend Solutions, Standardize Equipment Maintenance/Operation, Develop Quality Assurance Programs, Prepare Budget Recommendations, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Management: Define and Coordinate TO Requirements, Budget, Etc.

Air Base Group Administration

Administration: Store, Inventory, and Distribute TOs.

J—AIR FORCE SYSTEMS COMMAND (3)

Product Divisions and Flight Center

Application: Perform Sustaining Engineering, Perform Logistics/Operations Planning, Plan Spares and Equipment Requirements, Develop Training Requirements, Plan and review Systems Engineering Changes/Modifications/TO Changes

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Management: Define and Coordinate TO Requirements, Budget, Establish TOMA,Etc.

DTOMA

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Management: Define and Coordinate TO Requirements, Budget, Etc

Laboratories

Application: Perform Sustaining Engineering, Perform Logistics/Operations Planning, Plan and Review Systems Engineering Changes/Modifications, Perform Engineering for New Methods/Procedures/Materials, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Management: Define and Coordinate TO Requirements, Budget, Etc.

Safety

Application: Evaluation of Ground and Air Mishaps, Review of Replies to Mishap Reports, Establishing Programs, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Review, and Requisition

K—BASE LEVEL

Operations (1)

Application: Perform Operational/Contingency Planning, Develop and Monitor Operator Procedure Standardization, Evaluate Operator Proficiency,

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Maintenance (2)

Application: Perform Equipment Maintenance (Repair, Inspect, Service, Munitions and Special Equipment Loading, and Fault Isolate), Manufacture Components, Operate the Equipment, Perform OJT, Accomplish MDC Reporting, Inspect and Evaluate Reliability and Maintainability of Systems and Components, Order Parts, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Supply

Application: Spares and Equipment Requisition, Supply Management, Equipment Operation and Servicing/Inspection

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Civil Engineering

Application: Perform Base and Plant Maintenance

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Safety

Application: Evaluation of Ground and Air Mishaps, Review of Replies to Mishap Reports, Establishing Programs, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, Review, and Requisition

Procurement

Application: Review Bid Sets.

Field Training Detachment (1 and 2)

Application: Develop Courses, Operate Equipment, Perform Equipment Maintenance

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Simulator Training (1 and 2)

Application: Operate the Equipment, Perform Maintenance, Order Parts, Etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, and Requisition

Air Base Group Administration

Administration: Distribution and Requisition of TOs.

L--CONTRACTOR AND OTHER AGENCIES

Maintenance (2)

Application: Perform Equipment Maintenance (Repair, Overhaul Inspect, Service, Munitions and Special Equipment Loading, and Fault Isolate), Manufacture Components, Operate the Equipment, Perform OJT, Accomplish MDC Reporting, Inspect and Evaluate Reliability and Maintainability of Systems and Components, Order Parts, Quality Assurance, Etc.

Administration: Prepare Technical Order Changes, TO Registration, Filing, Distribution,and Requisition

Operations (1)

Application: Operate Equipment, Conduct Equipment Training, Etc.

Administration: Prepare Technical Order Changes, TO Registration, Filing, Distribution, and Requisition

Engineering

Application: Perform Weapon System Master Planning, Conduct Component and System Improvement Evaluations, Performing Structural Assessments, Determine Spares and Equipment Requirements Software Engineering, Develop Depot and Base System Maintenance Programs, Review and Approve/Disapprove TO Changes, etc.

Administration: Technical Order Change Processing, Registration, Filing, Distribution, In-Process Reviews, Pre Publication Reviews, Validation, and Requisition

Management: Define and Coordinate TO Requirements, Coordinated with TOMA, Create TOs, Etc.

Local Fire Departments

Application: Conduct Aircraft Rescue Training

Local Environmental Agencies

Application: Perform Environmental Assessments and Inspections

NOTES

(1) Operations includes the following: Aircraft, Support, Communication- Electronic, cryptological, Missiles, Transportation, Aerial Port and Fire Department Equipment, and Operations Centers, Etc.

(2) Maintenance in includes the following: Aircraft, Missiles, Munitions, Vehicles, support, Communications-Electronic, Cryptological, Weather and Reconnaissance, POL, PMEL, Medical, and Security Police Equipment, and Logistics Centers

(3) Performs functions Prior to PMRT

(4) Performs functions After PMRT

(5) Sub-functions include -- MM_Rs, MMEDs, and MMEDU at OC ALC